THE VETERINARY RECORD

FOUNDED BY WILLIAM HUNTING, F.R.C.V.S., 1888.

No. 22. JUNE 2, 1945 VOL. 57.

A Study of the Immunological Properties and Infectivity of Brucella Abortus Strain 45/20, McEwen, in Cattle

By

S. J. EDWARDS, R. S. DE ROPP AND D. H. McLEOD,

AGRICULTURAL RESEARCH COUNCIL, FIELD STATION, COMPTON, BERKSHIRE

The experiments described in this paper deal with a study of *Br. abortus* strain 45/20 isolated by McEwen, the characteristics of which have been fully described by him in the recent literature. They were designed with a view to providing further information on the following properties of the strain :

1. The value of strain 45/20 in protecting the susceptible pregnant heifer against virulent infection. For this purpose, 20 heifers were vaccinated two months before pregnancy with two doses of strain 45/20 and at the fifth to sixth month of pregnancy they received a virulent culture of *Br. abortus*, strain 544, by instilling a suspension containing a calculated number of organisms on the surface of the conjunctiva.

The vaccinated heifers were further divided into two equal groups, one group receiving 150 million virulent organisms while the other received one million.

The immunity of these two groups was compared with that of 20 unvaccinated heifers, divided into two similar groups, which received comparable doses of the virulent strain at the same stage of pregnancy.

2. The possible excretion of the organisms in the milk of vaccinated animals was investigated by injecting ten recently calved cows with two doses of strain 45/20 vaccine and examining the milk for the presence of *Br. abortus* at weekly intervals. Two months after vaccination these cows were served and at parturition a further search was made for *Br. abortus* in the foetal membranes and colostrum.

3. The ability of strain 45/20 to infect and persist in the tissues of the bovine was determined by injecting eleven non-pregnant and three pregnant cows. At weekly intervals following the injection of a single dose of vaccine, two of the vaccinated animals were destroyed and a search made for the presence of the organism in the lymphatic glands and other organs.

Vaccination Experiments in Heifers

Details of Experimental Animals and their Maintenance

The 40 Ayrshire and Friesian heifers selected in July, 1940, for this experiment were between 18 months and two years old. Their blood sera were examined by the agglutination test before they were placed under experiment and all gave negative results with the exception of one heifer which gave a doubtful reaction at 1 : 20. When the test was repeated 14 days later, however, the titre was not more than 1 : 10.

The agglutination test was carried out using a standard suspension prepared in the manner described by Stableforth (1936) and supplied by the Ministry of Agriculture Veterinary Laboratory, Weybridge. Interpretation of the test was made according to the recommendations of the *Br. abortus* Committee of the Agricultural Research Council which define a positive reaction at 1/40 and above and a doubtful reaction 1/20.

The heifers were kept in isolation units specially designed for conducting experiments on contagious disease and for convenience of description the units were named A, B, C and D. Each unit housed ten heifers, which were looked after by a single attendant, who was strictly forbidden to visit other units. Further precautions were exercised to prevent spread of infection from one unit to another, especially in the provision of double fencing, the outer being chain-link, around the 20-acre paddock attached to each unit. After calving or abortion, each animal was strictly isolated for four weeks in a calving box contained in the unit or in its own stall. Since all calvings or abortions except one took place in isolation within the buildings, it is believed that spread of infection from one animal to its neighbours was effectively controlled.

Vaccination.—On the dates 20.8.40 and 28.9.40, the 20 heifers occupying units C and D were injected subcutaneously with 8 c.c. of a suspension of strain 45/20 having an opacity equivalent to No. 10 tube of Brown's scale. The preparation of this suspension and its inoculation into the cattle was kindly undertaken by Dr. A. D. McEwen. The viable count of such a suspension was found by later tests to be 15,000 million organisms per c.c.

Mating.—Mating of these animals commenced on November 4th, just over five weeks after the last date of vaccination. Two bulls were retained at the compound for the purpose of service, one being used on vaccinated animals and one on clean animals. It seemed to be advantageous to commence this part of the programme as soon as possible, since the heifers appeared at this time to be frequently in oestrum. In view of the fact that 31 of the heifers were effectively served in November and December, it appeared that the majority of animals would receive the infective dose at the same stage in pregnancy. One heifer, B3, failed to come into oestrum.

Infective Dose.—On 23.4.41, when the heifers were in their fifth to sixth month of pregnancy, they were all exposed to infection with a virulent strain of *Br. abortus* by instilling a small quantity of a suspension of strain 544 (McEwen) on to the surface of the conjunctiva. This suspension was prepared from a 48-hour-old liver agar culture in Ringer solution containing 1 per cent. nutrient broth and adjusted to an opacity equivalent to No. 10 tube of Brown's scale.

The heifers in units A and C received 0·1 c.c. of a thousand-fold dilution, while those in units B and D received 0·1 c.c. of a ten-fold dilution.

Simultaneously, a viability count was made to estimate the numbers of brucella in these two injections. The first injection given to A and C animals was shown to contain 1 million organisms and that given to B and D animals, 150 million.

At the same time as the above test, the virulence of the infecting strain for guinea-pigs was estimated by the method used by McEwen (1940). From the original suspension (Tube 10 Brown), a suspension with opacity corresponding to Tube 3 was prepared, and from this dilutions of 1 : 10, 1 : 100 and 1 : 1,000 were made. From the original, as well as from the dilutions, one drop from a 26-gauge Vim needle (approximately 0·005 c.c.) was placed on the conjunctiva of each of ten guinea-pigs. After six weeks the guinea-pigs were killed and the presence of *Br. abortus* infection determined by culture of the spleen and by an agglutination test on the blood.

The following results were obtained :—

Dilutions	Approx. No. of Organisms	No. of Guinea-pigs Infected
Tube 3 (Brown's scale)	10 million	10
3/10	1 million	10
3/100	115,000	4
3/1,000	11,500	2

The spleens of infected guinea-pigs were greatly enlarged, even in those receiving the smallest dose, while agglutinins were present to a high concentration. This test, though not an exact quantitative test, shows that strain 544 was of the same high order of virulence at the time of infecting the cattle in this experiment as was assigned to it by McEwen (1940*a*) when judged by the same tests.

METHODS EMPLOYED FOR THE ISOLATION OF *Brucella abortus*

1. *Sites Examined.*—From animals which aborted giving birth to dead calves, quadruplicate samples were obtained as soon as possible from each of the following sites:—from the foetus—samples of stomach contents, lung, liver, kidney, spleen; from the dam—samples of allantoic fluid, cotyledons or vaginal swab if the former were not avaiable, 20 c.c. colostrum and a sample of blood.

From animals giving birth to live calves (premature or full term) quadruplicate samples were obtained from the following sites: allantoic fluid, cotyledons or vaginal swab, 20 c.c. of colostrum and a sample of blood.

After parturition, mixed quarter samples of milk from the vaccinated heifers in Units C and D were taken at intervals for examination for *Br. abortus*.

Specimens of all material collected were also examined by three other research institutes which were collaborating in this investigation.

These were: the Ministry of Agriculture Laboratory, Weybridge, the Institute of Animal Pathology, Cambridge, and the South-Eastern Agricultural College, Wye.

2. *Media used for Isolation.*—Tissues from foetuses were ground up with a small quantity of Ringer solution in Griffith's tubes and two large loopfuls (4 mm. diam.) of this material was plated out on the surface of each of the two following media:—

(*a*) Liver-agar (*p*H 6·8–7·0) containing neutral red (2 c.c. of 1 per cent. solution per 100 c.c.), glucose 0·5 per cent. and 1:500,000 crystal violet.

(*b*) Blood-agar containing 1:500,000 crystal violet.

TABLE I. UNIT A

Unvaccinated Control Group

Small Infective Dose 23.4.41. 1 million organisms of *Br. abortus*, Strain 544

Heifer No.	Days from service to infection	Days from infection to parturition	Agglutination Titres: Days after infection 14	28	49	70	84	97	119	147	174	204	278	Colostrum: Agg.	Cult.	Biol.	Foetal membranes: Cult.	Biol.	Foetus: Stomach Cult.	Biol.	Lung Cult.	Biol.	Liver Cult.	Biol.	Spleen Cult.	Biol.	Kid Cult.
1	154	123N	—	—	—	—	—	—	—	—	—	20	80	—	—	—	—	—	..	..	..	..	..	..	..	..	..
3	122	150P	—	—	—	—	—	80	80	160	640	1,280	640	640	+	+	+	+	..	..	..	..	..	..	..	..	..
4	160	107P	—	—	10	10	10	80	1,280	1,280	1,280	640	640	1,280	+	+	+	+	..	..	..	..	..	..	..	..	..
5	46	220P	—	—	—	40	—	—	—	—	—	—	160	—	+	..	+	..	..	..	..	..	..	..	..	..	..
6	162	111P	—	—	—	10	—	—	—	—	—	10	10	—	—	—	—	—	..	..	..	..	..	..	..	..	..
7	85	193N	10	10	20	20	10	10	10	10	10	10	—	—	+	—	—	—	..	..	..	..	..	..	..	..	..
8	19	269N	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	..	..	..	..	..	..	..	..	..
9	169	110N	—	—	—	—	—	—	20	80	160	160	80	10	+	+	—	—	..	..	..	..	..	..	..	..	..
10	57	220N	20	10	10	10	—	—	10	—	10	20	320	40	+	..	+	..	..	..	..	..	..	..	..	..	..
2	5	destroyed at 154 days, no calf *in utero*	—	10	20	40	80	80	160	80	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

A = abortion. P = premature. N = normal calving.

TABLE II. UNIT C

Vaccinated 20.8.40 and 28.9.40 with *Br. abortus*, Strain 45/20

Small Infective Dose 23.4.41. 1 million organisms of *Br. abortus*, Strain 544

Heifer No.	Days from service to infection	Days from infection to parturition	Agglutination titres: Days after infection 14	28	49	70	84	97	119	147	174	204	278	Colostrum: Agg.	Cult.	Biol.	Foetal membranes: Cult.	Biol.	Foetus: Stomach Cult.	Biol.	Lung Cult.	Biol.	Liver Cult.	Biol.	Spleen Cult.	Biol.	Kid Cult.
1	167	115N	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	..	..	..	..	..	..	..	..	..
3	148	143N	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	..	..	..	..	..	..	..	..	..
4	170	115N	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	..	..	..	..	..	..	..	..	..
6	135	176N	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	..	..	..	..	..	..	..	..	..
7	155	133N	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	..	..	..	..	..	..	..	..	..
8	170	106N	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	..	..	..	..	..	..	..	..	..
9	163	116N	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	+	..	..	..	..	..	..	..	..	..
10	162	52A	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2	not in calf		—	—	—	—	—	—	—	10	10	10	—	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
5	not in calf		—	—	—	—	—	—	—	—	—	—	—	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

TABLE III. UNIT B

Unvaccinated Control Group

Large Infective Dose, 23.4.41. 150 million organisms of *Br. abortus*, Strain 544

Heifer No.	Days from service to infection	Days from infection to parturition	Agglutination titres: Days after infection 14	28	49	70	84	97	119	147	296	Colostrum: Agg.	Cult.	Biol.	Foetal membranes: Cult.	Biol.	Foetus: Stomach Cult.	Biol.	Lung Cult.	Biol.	Liver Cult.	Biol.	Spleen Cult.	Biol.	Kid Cult.
1	140	73A	10	80	160	640	640	1,280	2,560	5,120	320	320	+	+	+	..	+	..	—	+	+	..	+	..	—
2	154	99P	—	20	40	160	160	320	640	160	..	2,560	+	..	+	+	..	..	..	..	..	..	..	..	..	..
4	164	51A	80	160	320	1,280	640	1,280	1,280	2,560	640	1,280	+	+	—	+	+	+	+	..	+	..	+	..	+	..
5	162	39A	—	80	320	2,560	2,560	2,560	1,280	1,280	320	160	+	+	+	..	+	..	+	..	+	..	+	..	+	..
6	166	38A	—	40	160	1,280	1,280	1,280	2,560	640	160	160	+	+	+	..	+	+	+	+	+	+	+	+	+	+
7	144	80P	20	80	40	160	160	160	320	320	80	320	—	+	+	+	..	..	..	..	..	..	..	..	..	..
8	168	69A	—	160	80	160	640	640	1,280	640	320	1,280	—	+	+	+	+	+	+	..	+	..	+	..	—	..
9	168	74A	20	20	40	40	160	320	640	1,280	..	320	+	+	+	+	+	+	+	+	—	+	—	+	+	+
10	155	25A	40	160	640	1,280	2,560	2,560	5,120	10,240	2,560	160	+	+	+	+	+	+	+	+	+	+	+	+	+	+
3	Sterile, not infected		—	—	20	160	80	80	160	160	80	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..

TABLE IV. UNIT D

Vaccinated 20.8.40 and 28.9.40 with *Br. abortus*, Strain 45/20

Large Infective Dose 23.4.41. 150 million organisms of *Br. abortus*, Strain 544

Heifer No.	Days from service to infection	Days from infection to parturition	Agglutination titres: Days after infection 14	28	49	70	84	97	119	147	278	Colostrum: Agg.	Cult.	Biol.	Foetal membranes: Cult.	Biol.	Foetus: Stomach Cult.	Biol.	Lung Cult.	Biol.	Liver Cult.	Biol.	Spleen Cult.	Biol.	Kid Cult.
1	161	118N	—	—	—	—	—	—	40	80	..	20	—	—	—	—	..	..	..	..	..	..	..	..	..	..
2	149	133N	—	—	—	—	—	—	—	160	160	20	—	+	—	+	..	..	..	..	..	..	..	..	..	..
3	155	71A	80	160	640	640	640	640	640	320	40	2,560	+	+	+	..	+	+	+	..	+	..	+	..	+	..
4	155	129N	20	40	20	13	—	—	160	160	20	40	—	+	—	+	..	..	..	..	..	..	..	..	..	..
5	164	116N	10	40	80	80	80	80	160	320	80	160	+	+	+	+	..	..	..	..	..	..	..	..	..	..
6	155	129N	—	10	10	10	10	10	—	—	—	—	—	—	—	—	..	..	..	..	..	..	..	..	..	..
7	140	140N dead calf	—	10	40	80	40	40	40	80	80	640	+	+	•—	—	..	..	..	..	..	..	..	..	..	..
8	155	107P	40	80	320	320	320	80	160	320	640	2,560	+	+	+	+	..	..	..	..	..	..	..	..	..	..
9	154	128N	10	20	20	10	10	10	10	20	10	40	—	—	—	—	..	..	..	..	..	..	..	..	..	..
10	14	264N	10	20	20	10	10	10	10	10	—	—	—	—	—	—	..	..	..	..	..	..	..	..	..	..

• = vaginal swab.

Samples from allantoic fluid, foetal stomach contents and colostrum were also spread thickly on plates of the same composition. These plates were then incubated in an atmosphere containing 10 per cent. CO_2 and examined after five to eight days.

Colonies suspected of being those of *Br. abortus* were investigated microscopically and by the slide agglutination test. If positive according to these tests, five or more colonies recovered from tissues of control animals in Units A and B and 20 colonies from vaccinated animals in Units C and D were sub-cultured on to liver-agar slants for subsequent investigation of cultural characteristics and virulence.

Where cultural tests gave negative results, the material (1 c.c. of a thick suspension) was inoculated intramuscularly into each of two guinea-pigs, which were killed after an interval of six weeks. Their spleens were removed, cultured on liver-agar and blood-agar and these media examined for the presence of *Br. abortus* after six days' incubation in 10 per cent. CO_2.

Results

The results of these examinations, together with the agglutination test histories are set out in Tables I–IV and they are further shown in composite form in Table V. With one exception there was general agreement between the workers at the four centres with regard to the isolation of *Br. abortus* from the heifers in this part of the experiment. The exception was a vaccinated animal, C9, referred to later, from which brucella was recovered by the Weybridge centre only.

Table V
Results of Vaccination Experiment

	Unit A Control		Unit C Vaccinated	
	Total	Infected	Total	Infected
Calved normally ..	5	3	7	1
Calved prematurely ..	4	3	0	—
Aborted	0	—	1	0

	Unit B Control		Unit D Vaccinated	
	Total	Infected	Total	Infected
Calved normally ..	0	—	8	4
Calved prematurely ..	2	2	1	1
Aborted	7	7	1	1

Small Infective Dose (1 million organisms)

Of the ten control heifers (Unit A) receiving the small infective dose, five completed a full-term pregnancy and four calved prematurely; one heifer was destroyed and a condition of diffuse lipomatosis was found at *post-mortem* examination but no calf was found *in utero*. This animal has, therefore, been omitted from the results of the experiment.

Of the five heifers calving to full term, *Br. abortus* was recovered from the colostrum only of two (A7 and A9) and, in addition, from the cotyledons of one (A10). From three of the four heifers calving prematurely (A3, A4 and A5) *Br. abortus* was recovered from both sites. A notable feature in this group was the absence of agglutination above 1 : 20 at the time of calving in the blood of four infected heifers and the slow rate of their development in the sera of the other two infected animals.

Of the ten vaccinated heifers (Unit C) two proved not to be in calf, while of the remaining eight, one (C10) aborted from non-specific causes. *Br. abortus* was recovered from the cotyledons of one animal only (C9) and in this case it was found by one of the four investigators as the results of biological tests. It is significant that no heifer in this group showed an agglutination titre higher than 1 : 10 at any time.

Large Infective Dose (150 million organisms)

One of the ten control heifers (Unit B) failed to show signs of oestrum. Seven out of nine heifers aborted, one 25 days only after infection, while two calved prematurely; all were infected with *Br. abortus*. The organism was recovered from aborted foetuses with the same frequency from the liver, spleen and lung as from the foetal stomach. Moreover, it may be noted that one heifer (B3), not exposed to experimental infection, became infected although non-pregnant. This spread of infection may have been due to the fact that another heifer in this unit aborted in the field attached. This was the only occasion on which an animal calved or aborted in circumstances which did not permit isolation and disinfection.

Of the ten vaccinated heifers (Unit D) one aborted and one calved prematurely due to infection with *Br. abortus*. The remaining eight calved normally but *Br. abortus* was found in the cotyledons and colostrum of four at calving. It is significant that the agglutination titres of the two heifers (D3 and D8) whose pregnancy did not terminate normally rose quickly to the same titre as that of unvaccinated heifers, whereas those of the four calving normally (D2, D4, D5, D7) rose very slowly, the maximum titre developed being only 1 : 80 before calving. One heifer (D1) showed a negative titre previous to calving and one of 1 : 40 at calving, which subsequently rose to 1 : 320; no *Br. abortus* was, however, recovered from this heifer.

Investigation of Post-parturition Milk Samples of Vaccinated Heifers

After calving, samples of milk strippings from heifers in Units C and D were examined at close intervals by the four centres.

The following technique for the isolation of *Br. abortus* was employed :—

Milk was allowed to stand in the cold over night and next day 0·5 c.c. of gravity cream was removed and spread on the surface of blood-agar containing 1:500,000 crystal violet, also on liver-agar with the same concentration of crystal violet and, in addition, glucose and neutral red. The plates were allowed to dry at 37° C. for two hours and after incubation for five to eight days under increased CO_2 tension were examined for colonies of *Br. abortus*.

In addition, a certain number of samples were examined biologically. For this test the cream of the four quarter samples was mixed and 2·5 c.c. injected into the thigh of each of four guinea-pigs.

The results are given in Tables VI and VII, where it will be seen that on no occasion was *Br. abortus* isolated from the milk of vaccinated heifers receiving the small infective dose (Unit C). The organism was, however, recovered from the milk of three out of ten heifers in the other vaccinated group and these animals had also been found to be infected at parturition. The milk of the three other heifers infected at this time was free from infection. It may be noted that *Br. abortus* was recovered from the milk of one heifer (D8) four and a half months after calving.

Inoculation of *Brucella abortus* 45/20 into Lactating Cows

Ten cows in early lactation were assembled in Unit E, similar in design to those used for accommodating heifers in the previous experiment. Their blood sera showed no evidence of agglutinins for *Br. abortus* and their milk was free from *Str. agalactiae*.

These cows were inoculated on August 20th and September 28th, 1940, with a suspension of strain 45/20 having an opacity equivalent to Brown tube 10. A dose of 8 c.c. of this suspension was given subcutaneously on both occasions. These cows were served on successive dates, commencing six weeks after the last date of vaccination.

Examination of Milk and Blood Samples during the Current Lactation Period

Quarter milk samples of the strippings were examined for the presence of *Br. abortus* by cultural methods each week and by a biological test every four weeks, using the methods previously

Table VI

Examination for *Br. abortus* in milk of vaccinated heifers in Unit C

Date of tests	Heifer / Date of calving	C1 16.8.41		C3 13.9.41		C4 16.8.41		C6 15.10.41		C7 3.9.41		C8 7.8.41		C9 17.8.41		C10 Aborted 14.6.41	
		Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Cult.	Biol.
2. 9.41		—	..	..	..	..	..	..	..	..	..	—	..	—	..	..	..
15. 9.41		—	—	—	—	—	—	..	..	—	—	—	—	—	—	..	..
30. 9.41		—	—	—	—	—	—	..	..	—	—	—	—	—	—	..	..
12.10.41		—	..	—	..	—	..	..	..	—	..	—	..	—	..	..	..
19.10.41		—	—	—	—	—	—	..	..	—	—	—	—	—	—	..	..
26.10.41		—	—	—	—	—	—	..	..	—	—	—	—	—	—	..	..
2.11.41		—	..	—	..	—	..	—	..	—	..	—	..	—	..	..	..
13.11.41		—	..	—	..	—	..	—	..	—	..	—	..	—	..	..	..

TABLE VII

Examination for *Br. abortus* in milk of vaccinated heifers in Unit D

Date of tests	Heifer	D1		D2		D3		D4		D5		D6		D7		D8		D9		D10	
	Date of calving	19.8.41		3.9.41		Aborted 3.7.41		30.8.41		17.8.41		30.8.41		10.9.41		Premature 5.8.41		29.8.41		11.1.42	
		Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Cult.	B ol.	Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Cult	Biol.
2.9.41		—	—	..	..	—	..	—	—	—	—	—	..	..	..	—	+	—	—	..	..
15. 9.41		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	..	..
30. 9.41		—	..	—	..	—	..	—	..	—	..	—	..	—	..	—	..	—	..	..	..
12.10.41		—	..	—	..	—	+	—	..	—	+	—	..	—	..	—	+	—	..	..	..
19.10.41		—	..	—	..	—	+	—	..	—	—	—	..	—	..	—	+	—	—	..	..
26.10.41		—	—	—	..	—	+	—	..	—	—	—	—	—	—	+	+	—	—	..	..
2.10.41		—	..	—	..	—	..	—	..	—	..	—	..	—	..	—	..	—	..	..	..
13.11.41		—	—	—	..	+	..	—	..	—	..	—	..	—	..	—	..	—	..	..	..
20. 2.42		—	..	—	..	+	..	—	..	—	..	—	..	—	..	+	..	—	..	—	..

described. The sera of each of the cows was tested for agglutinins against a smooth suspension of *Br. abortus* every four weeks.

The results of these examinations are set out in Table VIII.

The milk of eight cows was examined 43 times culturally and eight times biologically and on no occasion was *Br. abortus* found. Since one cow, E5, developed mastitis the milk could be examined culturally only seven times and biologically once, but no *Br. abortus* was found. Cow E7 was destroyed on account of advanced Johne's disease when milk examination had proved negative 25 times culturally and five times biologically. At *post-mortem* examination, mammary glands, cotyledons and foetal stomach failed to give evidence of infection with *Br. abortus*.

Agglutinins for *Br. abortus* did not develop in any of these cows during this period, except in the case of E8 in which the titre never exceeded 1 : 10 before parturition.

Recovery of Br. abortus *at Subsequent Parturition*

Of the nine cows in this group, eight gave birth to calves at full term, while one (E8) gave birth to twin calves prematurely. At parturition, specimens from foetal membranes, colostrum and blood were examined.

At calving, five of these nine cows proved infected with *Br. abortus*. The organism was recovered by three centres from two cows and from the other three cows by the Weybridge centre only.

TABLE VIII

Unit E. Lactating Cows Vaccinated with Strain 45/20 on 20.8.40 and 28.9.40

Examinations during current lactation period													Examinations at parturition						Subsequent blood agglutination titres		
Agglutination titres of blood														Foetal membranes		Colostrum		Agglutination titre		Dates		
	1940								1941													
Cow	20.8	20.9	22.10	22.11	23.12	23.1	26.2	26.3	21.4	21.5	2.7	Milk for *Br. abortus*	Calving date	Cult.	Biol.	Cult.	Biol.	Colo-strum	Blood	1941 13.11	1942 1.1	1942 2.2
E1	—	—	—	—	—	—	—	—	—	—	—	Examined culturally 43 times and biologically 8 times with negative results	16. 9.41	—	—	—	—	—	—	—	—	—
E2	—	—	—	—	—	—	—	—	—	—	—	"	9.11.41	not obtained		—	+	—	—	—	—	—
E3	—	—	—	—	—	—	—	—	—	—	—		15. 8.41	—	—	—	—	—	80	20	10	20
E4	—	—	—	—	—	—	—	—	—	—	—	"	30. 8.41	—	+	—	+•	—	—	—	—	—
E6	—	—	—	—	—	—	—	—	—	—	—	"	7. 9.41	—	+	—	—	—	—	—	—	—
E8	—	—	10	10	10	10	10	10	10	10	10	"	5.11.41 (P)	+	+	+	+	—	80	320	160	320
E9	—	—	—	—	—	—	—	—	—	—	—	"	5.10.41	—	+	—	+	—	—	—	—	—
E10	—	—	—	—	—	—	—	—	—	—	—	"	11.12.41	—	—	—	—	—	—	—	—	—
E5	—	—	—	—	—	—	—	—	—	—	—	cult. –ive, 7 times ; biol. –ive once	27.11.41	—	—	—	—	—	—	—	—	—
E7	—	—	—	—	—	—	—	—	—	—	—	cult. –ive, 25 times ; biol. –ive, 5 times	Destroyed Johne's disease. Mammary gland, cotyledons and foeta stomach cult. and biol. –ive at *post-mortem* examination.									

(P) = premature calving. • E4 also +–ive culturally from allantoic fluid.

TABLE IX

Examination for *Br. abortus* in post-parturition milk of cows in Unit E

Date of tests	Cow	E1		E2		E3		E4		E5		E6		E8		E9		E10	
	Date of calving	16.9.41		9.11.41		15.8.41		30.8.41		27.11.41		7.9.41		Premature 5.11.41		6.10.41		11.12.41	
		Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Cult.	Biol.	Cult.	Biol.
22.10.41		—	..	..	..	—	..	—	..	..	..	—	..	..	..	—	..	..	..
3.11.41		—	..	..	..	—	..	—	..	..	..	—	..	..	..	—	..	..	..
10.11.41		—	..	..	..	—	..	—	..	..	..	—	..	?	..	?	..	..	..
20.11.41		—	..	—	..	—	..	—	..	..	..	—	..	?	..	?	..	..	..
26.11.41		—	—	—	—	—	—	—	—	..	..	—	—	—	+	—	—	..	..
10.12.41		C	..	C	..	C	..	C	..	C	C	C	..	C	..	C	..	..	..
22.12.41		..	..	C	—	C	—	C	—	..	..	C	—	C	—	C	—	C	—
3. 1.42		—	—	—	—	—	—	—	—	—	—	—	—	—	—	C	—	—	—
12. 1.42		—	+	—	—	—	—	—	—	—	—	—	—	+	+	—	—	—	—
22. 1.42		—	..	—	..	+	..	—	..	..	..	..	..	+	..	—	..	—	..
6. 2.42		—	..	—	..	—	..	—	..	—	..	..	..	—	..	—	..	—	..
13. 2.42		—	..	—	..	—	..	..	..	—	..	..	..	+	..	—	..	—	..

C = Contaminated.

Specific agglutinins for a smooth strain were detected in the blood of one cow only, E8, which calved 18 days prematurely and showed a titre of 1 : 80 at this time and subsequently rising to 1 : 320. The organism was recovered by direct culture from the foetal membranes and colostrum of E8 and also from the allantoic fluid of E4. From the remaining infected cows (E2, E6, and E9) it was recovered biologically. The milk samples of these cows were examined on twelve occasions after parturition and *Br. abortus* was found in the samples of three cows E1, E3 and E8 as is shown in Table IX. One of these (E8) had been found infected at parturition but the finding of the organism in the milk of E1 and E3 provides evidence of two further cases of udder infection in this group. It is interesting to note that cow E3 had shown an agglutination titre of 1 : 80 at calving, and that the titre rapidly descended. Thus, seven recoveries of *Br. abortus* were made in this group of nine vaccinated cows.

The Persistence of Strain 45/20 in the Tissues of Cattle

This experiment was designed to ascertain whether strain 45/20 established itself in the tissues of the bovine and how long it could be recovered after infection. Hitherto, the evidence on this question had been limited to one experiment carried out by McEwen (1941) and it seemed desirable to investigate this point further with a view to providing information on the number of doses necessary for the immunisation of cattle in the field. Further trials in the protection afforded by one and by two doses of vaccine have been carried out and will be reported in due course by the *Br. abortus* Committee. In the present experiment ten cows and four heifers, all free from *Br. abortus* infection and believed to be non-pregnant were injected with a suspension of *Br. abortus* strain 45/20.

Methods

A primary culture was obtained from a dry culture of strain 45/20, kindly supplied by Dr. McEwen. This was sown on to the surface of liver-agar in Roux flasks. After 48 hours' incubation in 10 per cent. CO_2, the growth was washed off in Ringer solution containing 1 per cent. broth and standardised to an opacity equivalent to Brown tube 10. It was found that this suspension contained 15,000 million viable organisms per c.c. Each animal received subcutaneously, at the side of the neck, 8 c.c. of the suspension on 25.8.41.

It was planned that blood samples should be taken at intervals for the first week and examined for the presence of *Br. abortus*. Thereafter, two animals were killed each week and cultural as well as biological examination of various tissues made at *post-mortem*.

The following technique was employed for the examination of blood and tissues for the presence of *Br. abortus*.

Blood Examination.—Two to 3 c.c. of blood were removed into sterile tubes containing a quantity of citrate to give a final dilution of 3 per cent. and 0·5 c.c. of the citrated blood was added to 7 c.c. of melted liver-agar in boiling tubes at 40° C. (roll tube technique). After seven to eight days' incubation in an atmosphere of 10 per cent. CO_2, the tubes were examined for the presence of *Br. abortus*.

Recovery of Br. abortus from Tissues.—At *post-mortem* examination the following tissues were removed into sterile petri dishes :—

Glands—pharyngeal, sub-maxillary, bronchial, mediastinal, mesenteric, hepatic, internal iliac, sub-lumbar, and supra-mammary.

Organs—spleen, liver, kidney, uterus and udder. When the animal proved pregnant, cotyledons, foetal stomach and foetal lung were examined.

A portion of tissue was removed aseptically from each of the above sites into a sterile Griffith's tube and was ground with a little Ringer solution into a fine suspension. About six to eight loopfuls were spread on the surface of each of the two media (blood-agar and liver-agar) and incubated for six days in an atmosphere of 10 per cent. CO_2. Suspensions were made of eight groups of the above glands and organs and 1 c.c. of each grouped suspension was injected into each of two guinea-pigs. These were destroyed four weeks later and examined for infection with *Br. abortus*.

Table X

The Persistence of Strain 45/20 in the Tissues of Cattle

Animal (injected 25.8.41)	Days after injection	Recovery of *Br. abortus*		Sites Positive
		Cult.	Biol.	
Cow 1 ..	7	—	—	—
Heifer 1 ..	9	—	—	—
Cow 2 ..	14	—	+	Udder tissue and supra-mammary gland.
Heifer 2 ..	16	—	—	—
Cow 3* ..	21	—	—	—
Cow 4* ..	28	—	—	—
Heifer 3 ..	31	—	—	—
Heifer 4 ..	38	—	—	—
Cow 5* ..	45	+	+	Cotyledon; foetal lung (cult.); foetal stomach. (biol)
Cow 6 ..	47	—	—	—
Cow 7 ..	52	—	—	—
Cow 8 ..	54	+	..	Prescapular gland.
Cow 9 ..	78	+	..	Prescapular gland; bronchial gland; supra-mammary gland.
Cow 10 ..	80	+	..	Mediastinal gland; supra-mammary gland.

* Cows 3 and 4 proved at *post-mortem* to be in calf, while Cow 5 aborted on 7.10.41, and the foetal membranes showed necrosis typical of *Br. abortus* infection.

Results

Bacteraemia.—From blood samples of all the animals taken at 24-hour intervals for six days, no colonies of *Br. abortus* were identified.

Isolation of Br. abortus.—The results are summarised in Table X, from which it will be seen that the tissues of five out of the 14 animals yielded cultures of *Br. abortus* and that the organism could be demonstrated in Cow 10 destroyed 80 days after receiving strain 45/20. The organism had localised in the supra-mammary glands of three infected cows, while other glands infected were the prescapular, bronchial and mediastinal. Cow 5 proved to be pregnant and the injection of strain 45/20 caused abortion in this animal 45 days after dosage with typical necrosis of the cotyledons and invasion of the foetal tissues with the infecting organism.

The Cultural, Serological and Infective Properties of Strains Isolated from Experimental Cattle

CULTURAL AND SEROLOGICAL TESTS

Each strain of *Br. abortus* recovered from cattle in the preceding experiments was examined in respect of two metabolic characters, namely CO_2 sensitivity and H_2S production. The degree of "roughness" of a strain was assessed by its stability in saline at 100° C. while its sensitivity to the agglutinins in a positive bovine serum was also determined.

Methods Employed

For the cultural tests, primary cultures were made on liver-agar from individual colonies which had developed on plates inoculated with the original material. In the case of the unvaccinated cattle in Units A and B, five to eight colonies were picked from the plates for further examination. Since the material from cattle in Units C and D might contain either vaccine or infecting strain, between 20 and 40 colonies were tested whenever possible.

1. *CO_2 Sensitivity.*—Duplicate liver-agar slopes were sown with a small inoculum of the freshly isolated strain. One of these slopes was incubated in 10 per cent. CO_2 and the other in air, while for comparison a control slope inoculated with strain 45/20 was incubated in air at the same time.

2. *H_2S Production.*—A subculture of the strain was grown for 48 hours. Then a strip of lead acetate paper was inserted into the tube, extending to within half an inch of the agar. The cultures were incubated in 10 per cent. CO_2. Fresh test papers were inserted every 24 hours for four days and the degree of blackening was judged at daily intervals.

3. *Thermo-agglutination.*—Cultures grown for 48 hours in the first test were washed off with saline and the resulting suspension adjusted to an opacity equivalent to tube No. 10 Brown's scale. About 0·5 c.c. was drawn up into a pasteur pipette which was then sealed off and placed in a water bath at 100° C. for two hours. Readings were made at 5, 10, 30 minutes and at one, one and a half and two hours. A suspension of strain 45/20, prepared in a similar manner, was tested as a control.

4. *Serological Test.*—A thick suspension prepared from a fresh culture was diluted with phenol saline (1 per cent. phenol) to give an opacity equivalent to tube No. 2 Brown's scale. This was tested against a range of dilutions of positive bovine serum obtained from cattle which had been infected with *Br. abortus* strain 544.

The results of these tests are detailed in Table XI.

TABLE XI

Cultural and Serological Characteristics of Strains Isolated from Experimental Cattle

Source of Strain	Growth in Air	H_2S production	Thermo-agglutination	Agglutination titre with positive serum
A3, A4, A5, A9, A10	0	+ + for 2 days	Stable	1 : 8,000
A7	+	"	"	"
B1, B2, B4, B5, B6, B7, B8, B9, B10	0	"	"	1 : 5000 to 1 : 10,000
C9	0	"	"	1 : 10,000
D2	+	"	"	1 : 2,000 to 1 : 8,000
D3 (rough)	0	"	Ag. (3 mins.)	– ive
D3 (smooth)	0	"	stable	1 : 2,000 to 1 : 8,000
D4	+	+ + + for 4 days	"	"
D5	0	+ + for 2 days	"	"
D7	0	"	"	"
D8	+	"	"	"
E1, E2, E3	0	+ + for 4 days	"	"
E4, E6, E8, E9	+	"	"	"
Cow 2	0	"	"	"
Cows 5, 9, 10	0	"	Ag.	– ive
Cow 8	+	"	Ag.	– ive
Control 544	0	+ + for 2 days	stable	1 : 10,000
Control 45/20	+	+ + for 4 days	Ag. (3 mins.)	– ive

0 = no growth. + = growth as abundant as control. + + = moderate production. + + + = abundant production of H_2S. Ag. = agglutinated.

Strains from Cattle in the Vaccination Experiment

Strains from Units A and B.—Cattle in these units were exposed to infection with strain 544 only.

The strains recovered from the 15 infected animals in these units agree in their cultural characters with strain 544, with the single exception of the strain from A7 which was capable of growth in air.

Strains from Units C and D.—Cattle in these units were exposed both to the vaccinating and infecting strain.

It will be seen from the table that the only strain recovered from Unit C, namely from C9, resembled strain 544 in its cultural characters. Strains recovered from the six infected heifers in Unit D showed varying characters. Thus, strains from D2, D4 and D8 were aerobic but thermostable. Two strains were isolated from D3, one of which was proved to be as unstable in hot saline as strain 45/20 but differed from this strain in being CO_2 sensitive. The other strain from D3 and strains from D5 and D7 resembled 544 in that they were smooth and CO_2 sensitive. The strain from D4 differed in one respect from the other strains in the profuseness of its H_2S production.

Strains from Lactating Cows Infected with Strain 45/20

None of the strains recovered from the seven infected cows in this experiment resembled strain 45/20 in being both rough and aerobic. In fact, they were uniformly smooth and agglutinated to titre by a smooth serum. Three strains, those from E1, E2 and E3 were CO_2-sensitive while the other four, from E4, E6, E8 and E9 were aerobic. The strains were all profuse producers of H_2S.

Strains from Cattle in "Strain 45/20 Persistence" Experiment

Four of the strains recovered resembled strain 45/20 in that they were rough while one (from Cow II) was smooth. The latter strain was, however, recovered through the guinea-pig. It is significant that only one of these strains grew aerobically.

THE VIRULENCE OF STRAINS RECOVERED

A detailed description of the methods employed in assessing and comparing the virulence of strains 544, 45/20 and S.19 is described by de Ropp (1945). This method involves the injection of guinea-pigs with a known number of organisms and thereafter killing the animals at different periods of time after injection and assessing the degree and duration of splenic infection.

The virulence of the strains recovered from the animals in the present experiment was assessed by this method. It need only be mentioned here that equal volumes of freshly prepared suspension of all cultures isolated from each experimental animal were mixed and used for the test of virulence. Where rough and smooth strains were isolated from the one animal, as in the case of D3, separate tests were carried out.

Strains Recovered from Heifers in Units A and B

Since the animals in these units were exposed to infection with strain 544 only, it was to be expected that the organisms recovered from them would be as virulent as this strain. All tests performed confirmed this view, clearly indicating that infection developing in these animals resulted from their exposure to this strain.

Strains Recovered from Heifers in Units C and D

Animals in these units were exposed to infection both with strain 45/20 and with strain 544, so that it might be expected that organisms resembling both those strains would be encountered.

The single strain isolated from Unit C (from the foetal membranes of C9) was of the same virulence as strain 544.

The smooth strain from D3 and the strains from D2, D5, D7 and D8 also had the characteristics of 544 although the strains from D2 and D8 differed from the latter culturally in that they were able to grow aerobically. The rough strain isolated from D3 behaved in a manner comparable with strain 45/20 until six weeks after injection into guinea-pigs. It then became smooth and highly virulent, stimulating the production of agglutinins in high titre and evoking considerable hyperplasia of the spleen. The strain from D4 proved practically incapable of producing any infection of the guinea-pig at the level of dosage used and must be classed as being even less virulent than strain 45/20.

Strains Recovered from Cattle in Unit E

The cattle in this unit were lactating cows vaccinated before service with strain 45/20 in the early stages of lactation.

The strains isolated from the seven cows infected at subsequent parturition behaved differently from the vaccine strain.

Six of the strains were fully virulent, persisting in the spleen of the guinea-pig in large numbers for long periods, stimulating the production of agglutinins in high titre and causing marked splenic enlargement. The strain from E3 was not tested, having become contaminated in the course of drying.

Strains from Cattle in the "45/20 Persistence" Experiment

The virulence of the rough strains recovered from four animals was closely comparable with that of strain 45/20, but the remaining strain isolated from Cow II *via* a guinea-pig differed very markedly; it was smooth when isolated and behaved as a fully virulent strain. This strain had undergone passage through a guinea-pig before isolation and for this reason it is impossible to tell whether this enhancement of virulence occurred in the bovine or in the guinea-pig.

Discussion

In considering the results presented in this paper, attention may be directed to three principal points of interest, namely (1) the degree of immunity conferred by vaccination with strain 45/20; (2) the persistence of the vaccine strain in the bovine and the possibility of its excretion in the milk; (3) the likelihood of an increase in virulence of the strain during sojourn in the animal body. The last two subjects are of particular importance from their public health aspects, since the presence of an avirulent strain in the milk is objectionable and that of a fully virulent strain unacceptable.

The data yielded by the vaccination experiment substantiate McEwen's findings regarding the capacity of a vaccine prepared from strain 45/20 to prevent clinical abortion in cattle (McEwen, 1940*b*). This investigator found that when six heifers vaccinated with strain 45/20 were subjected during pregnancy to a dose of 145 million organisms of the virulent strain 544, all calved normally, although the foetal membranes and colostrum of three were infected with *Br. abortus*. In the present experiment, of ten vaccinated heifers exposed to infection with 150 million organisms of the same strain, one aborted and one calved prematurely due to infection with *Br. abortus*, while recoveries of fully virulent strains were also made in four of the eight remaining heifers calving at full term. In the unvaccinated control group exposed to a similar dose, seven heifers aborted and two calved prematurely.

The presence of infection in this vaccinated group must be related to the size of the infecting dose, a matter which may be considered in connection with certain findings of McEwen *et al.* (1939). After studying the effect of exposing groups of pregnant heifers to graded doses of a virulent strain of *Br. abortus*, these workers concluded that a dose 14·6 million virulent organisms was one sufficient to demonstrate immunity without overwhelming it. In the experiment now recorded the rapid intervention of abortion after exposure to the infecting dose in the control group, together with the high rate of abortion and marked necrosis of the cotyledons, indicate that the dose used was greater than would be encountered in the course of a natural infection.

On the other hand, the smaller dose of one million virulent organisms used for infecting the other two groups may have represented an exposure less severe than would be encountered naturally, because although six out of nine control heifers became infected, none of them aborted. At this level of dosage, however, vaccination with strain 45/20 resulted in a marked degree of immunity, since only one out of eight of the vaccinated heifers was shown to be infected with a virulent strain at the time of parturition.

Regarding the persistence of the vaccine strain 45/20 within the tissues of the bovine, a certain amount of data has been presented by McEwen (1940*b*, 1941). After injecting the organism into five heifers before pregnancy, he found that a normal calving followed in every case, and that *Br. abortus* could not be recovered either from the colostrum or from the foetal membranes, nor could any agglutinins be demonstrated in their sera. Again, when a group of three non-pregnant cows was injected with 4 c.c. of a suspension of strain 45/20 of opacity equal to No. 12 tube Brown scale, no *Br. abortus* organisms could be recovered from the tissues at *post-mortem* examination two months later.

The present experiments have not substantiated McEwen's observations. In the first place, it was found that the organism could be recovered from the tissues of four out of eleven non-pregnant animals destroyed at intervals after inoculation, and that it was present 80 days after inoculation—the maximum interval used in this preliminary investigation. A study of the strains recovered from these animals showed further that the capacity of strain 45/20 to grow without the addition of CO_2 is not a fixed characteristic, but is readily changed after passage through the bovine. In the second place, although this strain was not excreted in the milk of ten cows vaccinated before service during the current lactation, it proved possible, nevertheless, to recover *Br. abortus* from the foetal membranes and/or colostrum of five at the following parturition, which

took place about 12 months after vaccination. During the subsequent lactation period, the milk of one of these cows and also that of two further cows yielded cultures of *Br. abortus*.

Three possible explanations may account for the appearance of seven virulent strains of *Br. abortus* recovered at parturition from nine cows which had been inoculated some 12 to 14 months previously with strain 45/20. Firstly, it may be postulated that these cows were harbouring infection before they were vaccinated with strain 45/20 in August, 1940. This occurrence is most unlikely, since the nine cows had been blood tested on four occasions over a period of twelve months before being placed under experiment and no suspicion of a positive reaction was found during this time. Furthermore, although all the animals on the Station have not been entirely free from contagious bovine abortion at all times, the herd from which the cows in this experiment were taken was consistently free from infection as shown by the results of regular tests not only during the whole time since the Station was acquired by the Council in 1937, but also during the course of the experiment—a period of 18 months—all the animals in the dairy herd passed the agglutination test on six occasions.

Secondly, an alternative explanation may be that a chance introduction of infection took place in the experimental unit where the cattle were maintained. It has been stated at the beginning of this paper that the cattle were kept in 20-acre paddocks enclosed by a double fence, the outer of which was of the chain-link type, which made direct contact with other cattle impossible during the experiment. This unit was also well isolated from those which contained the heifers forming the vaccination experiment. Strictly isolated, as these cattle may have been, however, accidental introduction of infection should not lightly be dismissed as impossible, but in this event it would then have to be admitted that vaccination with 45/20 had failed to protect seven out of nine cows from contracting a natural infection with a virulent strain. Furthermore, with the exception of one cow (E8) which showed a regular low titre of 1 : 10, none of the cows showed evidence of blood agglutinins during pregnancy. The evidence presented by the heifers in Unit D, which were vaccinated with 45/20 and later exposed in pregnancy to the virulent strain 544 shows clearly that three heifers (D4, D5 and D7) developed a positive reaction when inoculated with the virulent strain, even though their pregnancy terminated normally. Thus, it may be concluded that an immunity developed by 45/20 sufficient to prevent clinical abortion is not necessarily sufficient to prevent an agglutinin response so that it seems highly probable that, if the cows in Unit E had been exposed to an accidental field infection, some of the seven infected animals would have shown the presence of agglutinins in the blood prior to parturition. In fact, none of the cows developed agglutinins during pregnancy and two only did so at parturition, in one of which the titre was only 1 : 80 falling in three months to 1 : 10, while the other showed a moderately high titre.

The third, and in our opinion the most tenable explanation on the evidence available, is that the strains recovered were in fact the original 45/20 strain which after sojourn in the tissue had become enhanced in virulence. The fact that *Br. abortus* strain 45/20 is prone to such a change in virulence, both in guinea pigs and in cattle, has been clearly demonstrated by McEwen (1940*a*). In describing the evolution of this strain in the guinea-pig, he stated that the parent strain was a smooth strain but during passage it became rough at the 20th passage, whereas the 40th passaged variant behaved in a manner comparable with a virulent field strain. The same change was observed in heifers inoculated with this strain during pregnancy. In five pregnant heifers the inoculation of 45/20 established infection in four, resulting in the production of abortion in two and a premature calving in one, and the strains recovered were all thermostable and agglutinated with smooth serum. All the strains examined showed an exaltation of virulence and one strain showed the characters of a virulent field strain when inoculated into guinea-pigs. It is also interesting to note the development of agglutinins in the blood of these four infected heifers. In only one did the titre rise to a high level (1 : 640) and this was observed after abortion occurred, while in the other three heifers the development of agglutinins was delayed and never exceeded the moderate level of 1 : 80. The presence of agglutinins at a low level in these highly susceptible heifers suggests a parallel with the findings in the Unit E cattle, which were inoculated before pregnancy, where in two only was an agglutination titre developed coinciding with parturition. McEwen, in his explanation of the presence of agglutinins in the four heifers, states that it is unlikely to have resulted from residual traces of smooth antigen in the inoculated strain 45/20 but inclines to the view that they resulted from a true mutation of the rough to a smooth strain within the tissues.

When the results of the experiments described in this paper are considered in conjunction with those of McEwen, it may be concluded that the use of a living *Br. abortus* vaccine prepared from strain 45/20 protects cattle against clinical contagious abortion and confers considerable immunity against infection with virulent *Br. abortus*. But, while the number of animals involved in the present experiment is small, the evidence points to the fact that strain 45/20 after inoculation into the non-pregnant cow may in some animals persist in the tissues and subsequently undergo mutation from the rough state to a smooth virulent form.

Summary

1. When a group of ten heifers vaccinated before pregnancy with *Br. abortus* strain 45/20 (McEwen) was exposed, during pregnancy, to infection with 150 million viable organisms of the virulent strain 544, the infecting strain was recovered from the colostrum and foetal membranes of six of the animals. One of these aborted and one produced a premature living calf, while the remainder produced full-term calves. Thus nine living calves were obtained from the ten vaccinated heifers.

In a group of nine unvaccinated control heifers exposed to the same infecting dose, all became infected. With the exception of two which had premature living calves, all aborted dead calves. Thus, two living calves were obtained from the nine control heifers.

2. When a smaller dose, namely one million organisms of strain 544, was used to test the immunity of eight vaccinated heifers, one aborted from non-specific cause and one developed a light infection of the foetal membranes. Thus seven living calves were obtained from the eight vaccinated heifers.

In a control group of nine pregnant heifers exposed to the same infecting dose, six became infected. Three gave birth to premature living calves and the remainder to full-term calves. Thus, nine living calves were obtained from the nine control heifers.

3. It was found by *post-mortem* examination of eleven non-pregnant cattle killed at intervals after infection with strain 45/20 that the organism persisted in the tissues of four and that it could be recovered after an interval of 80 days.

Of nine lactating cows vaccinated before service with this strain, *Br. abortus* was isolated at subsequent parturition from the foetal membranes and or colostrum of five. *Br. abortus* was also found in post-calving milk samples from two further cows.

4. The virulence of the strains recovered from these infected cows was found to have become exalted so that it was equal to that of a fully virulent strain.

References

McEwen, A. D., Priestley, F. W., & Paterson, J. D. (1939). *J. comp. Path. & Therap.* **52.** 116.
McEwen, A. D. (1940*a*). *Vet. Rec.* **52.** 97.
——. (1940*b*). *Ibid.* **52.** 815.
——. (1941). *Ibid.* **53.** 351.
de Ropp, R. S. (1945). *J. comp. Path. & Therap.* In press.
Stableforth, A. W. (1936). *Ibid.* **49.** 251.

The authors wish to express their thanks to Drs. A. D. McEwen, A. W. Stableforth and J. S. Paterson for their assistance in the bacteriological examination of specimens in this investigation and to Dr. W. S. Gordon for his helpful advice in the presentation of the paper.

This work was carried out under the general supervision of the Committee of the Agricultural Research Council on *Br. abortus* infection in animals and man.

"PANEL" SCHEME PROGRESS

"Figures of the number of dairy cows now covered by the scheme for the control of dairy diseases are not impressive," writes "Blythe" in the May 22nd issue of the *Farmer and Stock-Breeder*, and proceeds: "In England and Wales, 6,784 herds, embracing 269,750 head of cattle, and in Scotland 299 herds, with 19,100 cattle, are under the scheme. This represents less than 10 per cent. of the milking herd of the country and to me seems a rather low proportion.

"There are, I know, many obstacles to rapid or extensive development. The scarcity of veterinary surgeons is the chief of these causes, and labour shortage and petrol restrictions also count, but I fear that until the Government take a hand and 'push' the scheme the dairy industry will always be the victim of criticism, much of it unfair, from persons who say, without troubling to be accurate, that our herds are 'riddled with disease.'

"Of the counties taking part in the 'panel' veterinary scheme Cheshire leads in number of herds with 394, embracing 17,433 head of cattle, but Hampshire has the largest number of cattle on the panel—17,992, in 384 herds. I am surprised to find that Cornwall, with so many splendid Guernsey and South Devon herds, has only four herds and 147 cattle under the scheme.

"In Wales, Carmarthen has a big lead with 6,839 cattle in 250 herds, and in Scotland Fife is ahead with 37 herds and Ayrshire is second with 34. Believing that this is one of the best steps we have yet taken to reduce cattle disease, I hope we may get a move on."

CLINICAL COMMUNICATION

The Use of Barium Chloride Intravenously

LINDSAY AUCHTERLONIE, M.R.C.V.S.
Nottingham

The writer's attention was drawn to the use of barium chloride, by intravenous injection, for the treatment of colic in the horse, by an article in the *Pennsylvania Bulletin*, No. 68, October 15th, 1937. The author, Amadon, stated that "barium chloride in proper doses, given intravenously, accomplishes a thorough unloading of the intestine, which is also painless."

The frequent fatalities recorded have discouraged its use, even by those who have never tried it.

Barium chloride has a stimulating action on all three varieties of muscle, *i.e.*, regardless of nervous control. It is scarcely used in human medicine and is mostly adapted for analytical purposes.

Its alimentary action being now under consideration, it is not proposed to deal with the effects produced on other types of muscle, except that its action on the heart is similar to that of digitalis. By stimulation of these fibres the cardiac rate is slowed down and it is advisable to take the pulse before injection because any pronounced depression is sufficient to discourage a repetition (Amadon). The writer has not encountered any case in which it has been found necessary to refrain from giving subsequent doses on this account.

Normally, peristalsis occurs through pressure stimuli of the bowel contents, inducing wave-like action of the circular muscle coat.

In the presence of unusually powerful stimulation of the muscle by the nervous mechanism, considerable lengths of bowel enter into a state of spasmodic contraction. This is a type of motility possessing little functional value and it gives rise to pain, as for example, by the use of arecolin, eserine, carbachol, etc.

Amadon, in the *Pennsylvania Bulletin*, gives his experiences of the comparative use of barium chloride and drugs of the above type, over a period of 19 years, and he had no fatalities. He stipulated, however, that the dose must be controlled, *i.e.*, there must be as wide as possible a margin between the therapeutic and lethal doses. The maximum dose allowable is 7½ grains; this is dissolved in 20 to 25 c.c. of distilled water and is injected slowly because of its action on the heart, so that too great a concentration of the drug is not present in the heart at any given moment. Now, Banham's "Posology" (sixth edition) gives the dose as from *4 to 20* grains. Hoare comments on the violence of its action and points out that the risk of rupture of viscera surely indicates the choice of more safe agents. The dose given is from *8 to 25* grains. Milk puts the dose at from 7½ *to* 15 grains.

Amadon applied it to cases of tympanites and even when toxic paresis of the intestine existed.

This has been the writer's experience and notes on one case (which are appended) indicate that the paralysed viscus may be stimulated with safety as by no other method. The writer considers that the use of the *phonendoscope* is an essential part of the method, as it always should be when a case of colic is being attended.

Only by auscultation can the picture be reasonably completed. This is as necessary as the taking of pulse and temperature and the rectal examination.

In addition to the ordinary type of spasmodic colic barium chloride gives satisfactory results with subacute impaction of the colon and digital proof of its effects may be obtained from time to time.

It is the writer's practice to repeat the injection where auscultation fails to reveal sufficient intestinal action, but in only one case has a third injection (over a period of three hours) been necessary. Mineral oil, of course, is administered when refractory cases are encountered. Except in the fatal cases (volvulus, etc.) there has been a marked diminution in the number of the "all night and all day" type of case. In fact, in several years the only lengthy case was the one recorded below. One has, for a long time, had the feeling that "I can get this one right before bedtime."

No case of rupture of the stomach has occurred where barium was used and there has been no rupture of other viscera. A case of partial strangulation of the small intestine just behind the stomach, due to torn mesentery, was found to have an intact loaded stomach.

In this case barium was used twice. Quite frequently cases of lengthy duration have had immediate relief after injection, and it is uncommon for prolonged pain to be classed as attributable to its use. This is not so with the vagal stimulators.

Amadon has stated that there is no indication that barium chloride acts on the rumen. The writer has only recently begun to observe the action of the drug on this organ but the results are encouraging. A yearling heifer, in a state of tympany and reeling from the effects of gorging on wheat, showed good rumenal activity after two 7½ gr. injections in an hour. She recovered. One of several cows tightly blown with eddish and having also got among the cabbage, showed good action when a second 7½ gr. was given one and a half hours later.

A 15-month Shorthorn bull, with marked tympany of unknown origin, required only one 7½ gr. dose, which acted within two hours.

It is likely that the bovine safe dose may be higher than in the horse. At all events it is proposed to give larger doses on account of the huge mass which has to be moved.

As in the horse, "long term" treatment may be applied also but the object of this paper is to submit that there is another method to hand of safely arriving at "halfway house" where Nature can be trusted to do the rest.

. . . . .

A Case of Enteritis in the Horse

Subject.—An aged Shire mare of a good type.

History.—Symptoms of colic were observed after the last feed of the day prior to my being called in. The mare did not clear up all the feed and the owner reported that she had been in almost continual pain all night. Very little dung had been passed but flatus had been heard periodically. During the night (9 p.m.) the owner had given a physic ball but its weight could not be ascertained. She had also received a bottle of medicine which appeared to have contained turpentine, and evidently also a homoeopathic dose of belladonna, judging by the size of the bottle and the description on the label.

Examination.—Five or ten minutes were allowed for inspection and during this period moderate continuous pain appeared to be present. Although the mare was unclothed and the weather was cold, sweating was noticed. *Conjunctiva* dusky pink. *Pulse* 80 and full. *Temperature* 102°. *Respirations* not counted. *Auscultation* indicated occasional good movement but there were long periods of quiet. Tympany was not evident but the mare was in good condition and it was difficult to make a decision on this point. Rectal examination showed an empty viscus covered with mucus. Tenesmus did not occur and no solid dung could be palpated even in the contiguous colon.

No treatment was offered at this visit but two hours later, when a similar picture was present, full doses of ammon. carb. and sod. bic. were given in a quart of water, after which there was slightly increased pain. At the third visit (about four hours) the temperature was 102·4 and the pulse 90 and still full and bounding. Pain was still continuous but there appeared to be slight remissions. Auscultation showed little change from the previous findings. There would be an occasional good borborygmus and then silence.

Rectal examination provided nothing new, much tenacious mucus being present. At this stage I enquired about the feeding and was told that the mare had been fed solely on wheat chaff (ears) and oats and she had had no long fibre of any description since Xmas (about 2½ months). A diagnosis of acute enteritis due to retention was then made and Tr. opii ℥i ss Tr. belladonna ℥i was given in a little water, followed immediately by 60 oz. of mineral oil.

At the fourth visit (seven hours) the pain was obviously continuous and more severe bouts were noticed. Temperature 103° and pulse 95. Conjunctiva was getting duskier and the bowel sounds were less evident. Rectal examination did not induce tenesmus.

When the fifth call was made it would be about 24 hours after the owner had given the physic ball and about twelve hours after my first visit. The temperature was then 103·5 and the pulse rate, partly taken by auscultation, was from 110 to 120, but there was yet power in it. The nostrils were fully dilated. Bowel movements were occasionally loud. Rectal examination indicated no solid dung anywhere within reach.

Barium chloride 7½ grains in 20 c.c. of water was given intravenously, and almost immediately the mare went down and appeared to be in great pain. A lot of watery mucus was soon voided and occasionally some free flatus. I made provisional arrangements for the autopsy and left for the night, not feeling very well.

In the morning the temperature was 102° and the pulse 80, and the mare had drunk some water. There was some dung on the ground and the owner reported that the last injection (the intravenous) had cured her, in his opinion, because about two hours after it the mare appeared much easier. I injected 50 mg. B_1 subcutaneously and ordered tepid water with some salt added to it and a pound of treacle spread over the day. The mare eventually recovered but her temperature did not return to normal, *i.e.*, to

around 100, for over a fortnight, 100·5° F. to 101° or slightly over being the average.

Discussion. In the absence of a *post-mortem* examination it would be impossible to state with any degree of certainty what actually did occur, but there is no doubt that a short chop diet fails to induce proper peristalsis and it is accompanied by retention and irritation. Hypovitaminosis B_1 is probably an accompanying factor.

All of the bowel need not necessarily be equally involved, hence the occasional loud sounds which came usually from about the caecum. In a similar case which had had only short chop for three months the small intestine was inflamed but not uniformly so and the caecum was inflamed and full of the chop but it was not impacted.

Turpentine and aloes are to be avoided; at least they should be kept in the background until ample time has been given for a diagnosis to be made. Turpentine alone can well make all the difference in such cases between life and death. Retained aloes also adversely influences the course.

Barium chloride in controlled doses is safe to use in cases of enteritis. As far as the writer is aware there is no other drug which will act quite in the same way, but it must be given judiciously

ABSTRACTS

[**Man as a Source of Bovine Tuberculosis in Cattle.** Tice, F. J. (1944.) *Cornell Vet.* **34**. 363-365.]

This article records the incidence of tuberculosis in three herds of dairy cattle consecutively owned by one man during a period of two and a half years. The first herd of 25 animals all reacted to three tuberculin tests within 100 days (5, 13 and 7 reactors).

Primary testing was made because milk from this herd had caused tuberculosis in another owner's calves which were otherwise in tubercle-free conditions.

Twelve tested cows purchased to form a second herd all became reactors within five months of passing into the owner's possession and a similar experience is recorded in the case of a third and smaller herd which also was made up of tested animals. After each test all reactors were slaughtered, stables were cleaned and disinfected and sources of additions were checked. No generalised case of tuberculosis was found *post mortem*.

The owner was tuberculous, however, and tubercle bacilli of bovine type were isolated from his sputum and from the lymph nodes of the cattle.

Another herd is mentioned with a similar history where an owner suffering from pulmonary tuberculosis was thought to have infected some of his cattle.

The author calls for thorough investigation of the origin of tuberculous infection in what are termed "problem herds."

C. V. W.

* * * * *

[**The Necessity of the Corpus Luteum for Maintenance of Pregnancy in the Ewe.** Casida, L. E., and Warwick, E. J. (1945.) *J. anim. Sci.* **4**. 34-36.]

Removal of the corpus luteum at the 30th day of pregnancy produced abortion in one ewe. Normal lambs, however, were produced by two of six ewes which were ovariectomised between the 54th and 77th days of gestation, and by two of four ewes subjected to ovariectomy or enucleation of the corpus luteum between the 99th and 103rd day. From the limited data it would appear that in some cases after the first eight weeks of gestation, the corpus luteum may not be necessary for the maintenance of pregnancy in the ewe.

A. T. C.

* * * * *

[**Merits and Deficiencies of Mastitis Diagnostic Methods.** Schalm, O. W. (1944.) *J. Amer. vet. med. Ass.* **105**. 398.]

The results of examining 4,132 milk samples by cultural and microscopical tests are compared with the Hotis readings. These latter are divided into negative, suspicious, four grades of positive and contaminated. The microscopical examination readings were recorded by a key according to the number and type of bacteria and leucocytes present. 14·3 per cent. of all the samples contained *Str. agalactiae*. While the microscopic method revealed 93·8 per cent. of the positive samples it gave double the correct number of positives (1,098 positive microscopically, 594 culturally). The Hotis test showed 621 positive samples, of which 594 actually contained *Str. agalactiae*. The author claims that by combining the two tests according to the key given, only 5 per cent. of the culturally positive samples would be regarded as negative.

P. S. W.

Questions and Answers

"Questions and Answers" will be published on alternate weeks.

The submission of questions for inclusion in this column will be welcomed: they can relate to any aspect of veterinary work. For purposes of record, each question is numbered, and those submitting questions are required to furnish (not for publication) name and address.

Answers to readers' queries represent exclusively the personal opinions of the writers, and criticism of the replies will be appreciated.

All communications should be addressed to the Editor.

Sinus Opening on Side of Teat

Q. LXXVII.—*What is the best methoa of dealing with a sinus opening on the side of a teat when it drains a small supernumerary quarter?*

A.—The optimum time to deal with a sinus draining a small supernumerary quarter on the side of a teat is when the cow or heifer is dry.

If in milk one would advise milking it out if the amount of secretion was large, as estimated by the distension of the supernumerary quarter, and if the sinus draining the quarter interfered with the milking of the quarter proper. These small supernumerary quarters usually tend to dry up fairly quickly even if milked or squeezed out temporarily. Surgical procedure is to cleanse with spirit, use local anaesthetic either by a circular wheal around the base of the teat to desensitise all below it or by a circular wheal around the operation area. With aseptic precautions the sinus along the teat proper is then dissected out along its length and the wound sutured with fine silk worm gut or nylon, using Halsted type sutures, and dressed with sterilised sulphanilamide. No after treatment is required usually, the sutures being removed on the seventh or eighth day.

When the udder is "stocking" at the subsequent lactation, there is usually some degree of enlargement of the now "blind" quarter, which recedes gradually in a varying period of days.

. . . . .

Restraint of Bulls

Q. LXXVIII.—*What is the best method of restraint for the castration of rejected bulls?*

A.—The bull is held by a halter through a ring, or chain, or stanchion, against a wall of the box. The left hind limb may be restrained by a side line, or in a refractory animal from the nose-ring or "bulldog," to the limb above the fetlock. An assistant is needed to hold the tail and keep the right side of the bull against the wall by pushing against the left flank. Local anaesthesia and the operation are carried out by operator from behind. The writer has operated on even older bulls than those envisaged by the question by this means with little trouble, and in a much shorter time than if the animal is cast and secured by hobbles.

. . . . .

Swine Fever in Sows

Q. LXXIX.—*During the past year or two I have met several outbreaks of swine fever in sows, the store pigs on the premises only becoming ill after a week or two. What is the explanation of the adult stock becoming affected first?*

A.—There is little difference in the relative susceptibility to swine fever between adult and store pigs; the morbidity is about the same but the mortality is usually lower in the adult stock. The circumstances described would appear to be exceptional and provided both groups received the same diet, one can only conclude that the adult animals were the first to be exposed to infection.

. . . . .

Pyometra in the Bitch

Q. LXXX.—*Has any really successful treatment been evolved for the cure of pyometra in the bitch?*

A.—The only completely successful treatment of pyometra in the bitch is radical operation, *i.e.*, hysterectomy. Provided operation is undertaken before the bitch has become grossly toxic from the condition, prognosis is favourable.

Several other methods of treatment have been evolved, some of the most popular being: Sulphonamide/pituitrin therapy, pituitrin alone, and more recently stilboestrol either alone or combined with the use of sulphonamide or pituitrin. These latter methods give a percentage of successful recoveries, but undoubtedly fail in a proportion of cases and in any event all have the disadvantage that the condition may recur after an ensuing oestral period.

Errata.—In the abstract (*Vet. Rec.* **57**. 201) of the article by Elvehjem and Sober, "The Nutritional Significance of Grass," the values for vitamin B, riboflavin, vitamin B_6, pantothenic acid, nicotinic acid and biotin should have been in μg per gramme. The remaining values were correctly printed in milligrammes.

It should be borne in mind that pyometra in the bitch is not an active infection in the majority of cases, but is a condition due to a degeneration of the uterine mucosa with subsequent exudation. The fluid thus accumulated in the uterus may or may not become infected; it is interesting to note that the discharge in some cases is bacteriologically sterile. It will readily be appreciated, therefore, that whilst clinical recovery may follow one or other of the medical methods outline above, the degeneration of the endometrium is in no way affected and thus the condition will be likely to recur. In short, hysterectomy is the treatment of choice and will produce a high proportion of recoveries if operation is performed as soon as a diagnosis can be made.

. . . . .

Alopecia in Dachshunds

Q. LXXXI.—*Can you advise me of the cause of and most successful treatment for alopecia in Dachshunds?*

A.—In the writer's view alopecia in Dachshunds is almost invariably due to chronic and often sub-clinical infection with *Demodex folliculorum*. Only a very small percentage of Dachshunds in this country is free from infection with this parasite.

The condition frequently remains dormant so long as the dog is in first-class condition and the coat may appear to be perfect; the disease shows itself as a clinical entity during any period of strain, *e.g.*, during lactation, pregnancy or even such slight disturbances as oestrus or coat change; also during or after any debilitating disease. Even then the condition may not proceed beyond a loss of hair on the ear, under the neck and around the hocks. In contradistinction to the more acute form seen in puppies it may be extremely difficult to demonstrate the causal parasite in skin scrapings.

Treatment should be designed to improve the dog's general condition by good feeding, the administration of cod-liver oil, syrupus ferri phosph. Co., arsenical preparations, etc. The alopecia will often disappear spontaneously when condition improves, but systemic treatment may be augmented by the local application of suitable dressings. The secret of success in treating Demodex cases seems to be the frequent changing of dressings, no one preparation being used for longer than 10 to 14 days at a time. Dressings which have proved useful are: Salicylic preparations as linimentum salicylicum or Whitfield's ointment (ung. ac. benzoic co.), sulphur preparations as lin. sulphur, Odylen (when available), Novidol, etc. Dermynox (B.W.) has been used with success.

Alopecia in any breed may be due to an apparent thyroid deficiency, or may be seen as a senile change in old dogs; improvement in such cases often follows administration of thyroid extract, possibly combined with a course of potassium iodide, or in senile cases castration or ligating of the vasa deferentia may be successful.

. . . . .

Sulphanilamide Dispensing for Local Application

Q. LXXXII.—*May sulphanilamide be dispensed into an emulsion for local application?*

A.—Sulphanilamide is nearly always applied to wounds as a fine dry powder, but it may be used as a thick suspension prepared by adding 2 g. powdered sulphanilamide to 100 ml. of a 0·8 per cent. solution of sulphanilamide in physiological saline solution. Application is made at least three times daily.

The drug may be made into an ointment of any desired strength by using ung. aquosum B.P. as the base. The latter is the permitted basis of most ointments at the present time and consists of distilled water 24, borax 1, arachis or cottonseed oil 50, with white beeswax and white soft paraffin. Ulcers may be treated with the following paste: benzoic acid 0·2 per cent., sulphanilamide 0·8 per cent., glycerine 10 per cent., powdered tragacanth 10 per cent. in Ringer's solution.

Once infection is established in a wound, it may be desirable to give the drug by the mouth.

WEEKLY WISDOM

The practical approach of people to unity is through full information, fully discussed. With the facts before us we are in a position to see what is common ground, to assess the value of criticism, and judge how best to resolve and reconcile differences, rather than to exploit them for political ends or sectional advantage. For this we need discipline, but it must be self discipline, self-imposed by public consent, rather than by regimentation. This is the British way. It calls for a certain genius for common sense and tolerance, for moderation and not running to extremes, for respecting the positive qualities of opponents, while recognising that criticism must have its proper place.—Sunday Times.

IN PARLIAMENT

Agriculture (Artificial Insemination) Bill

Prior to the Whitsuntide Recess, the above Bill was accorded its Second Reading by the Commons. In moving, Mr. T. WILLIAMS (Joint Parliamentary Secretary to the Ministry of Agriculture) said that about this time two years ago the House approved legislation endorsing the principle of a controlled and orderly development of artificial insemination in this country. A great number of problems still required investigation, including such questions as bull management and psychology, the keeping-quality and dilution of semen, and insemination methods and technique. The investigation of these problems was unsuitable at an ordinary commercial centre, where it was essential that there should be no risk of letting down the farmers who were dependent upon the centre for bull service. Accordingly, in Clause 1 of this Bill, the Minister of Agriculture and the Secretary of State for Scotland were seeking the authority of the House to enable them to set up and operate artificial insemination centres, where research and experiments could be carried out. These centres would also require experience of practical methods of operation and would, therefore, naturally provide a limited service to farmers in the neighbourhood. The Clause would enable them to give financial assistance to outside organisations or private persons who were ready to carry out approved investigations into particular problems. This was desirable, as in some cases this might be the best method of getting an investigation of some particular aspect of the subject carried out.

In this country we had, up till now, thought of artificial insemination primarily for cows. It was possible that in time we might find it would prove equally useful for other classes of stock. Clause 1 had, therefore, been drawn wide enough to enable them to carry out investigations in the case of all animals, including poultry and bees—but not humans!

The second major part of the Bill was contained in Clauses 2, 3 and 4. This had rather a different object in view. An artificial insemination centre would take some time to get into full working order and in the meantime would incur heavy capital expenditure. Good bulls in this country were, unfortunately, not cheap. Experience had already shown that in the first two or three years centres were more likely to have to face losses than to make profits. Clauses 2 and 3, therefore, would enable the Secretary of State for Scotland and the Minister to make grants to any producer-controlled bodies responsible for the establishment and operation of artificial insemination centres for cattle in order to cover any approved losses during any accounting year during the period January 1st, 1945, to March 31st, 1950.

They were satisfied, that while it had its dangers, artificial insemination held out great promise as a method of improving the breeding of livestock and in particular, raising the standard of the smaller dairy herds where farmers would frequently be unable otherwise to get the services of a first-class bull. During the Second Reading Debate on the Agriculture (Miscellaneous Provisions) Act, 1943, his right hon. Friend said that while artificial insemination held out great possibilities for good it was also clear that it contained great possibilities for evil if it got into the hands of people who were going to exploit it purely for commercial gain. It was generally recognised that some system of control was therefore necessary. Representatives of the N.F.U., cattle breed societies, the Milk Marketing Board and certain scientific experts were consulted and his right hon. Friend adopted their recommendations that artificial insemination ought to be developed as a national service on behalf of the livestock industry. If this was to be done it was important that the development should be on an orderly plan, and that there should be no exploitation of artificial insemination by sectional interests or by commercial firms for the purpose of private gain. For this reason it was decided that the general policy would be to restrict the issue of licences to establish artificial insemination centres to farmer-controlled organisations such as the Milk Marketing Board, the cattle breed societies and the farmers' co-operative societies. Such bodies could be relied on to ensure that the interests of users of the centres would be fully safeguarded. It was in accordance with this policy of restricting licences to producer-controlled organisations that Government assistance under Clauses 3 and 4 would also be confined to such bodies.

He was glad to say that in England and Wales the Milk Marketing Board was taking a leading part in the establishment of artificial insemination centres. It was a very appropriate development of the Board's activities, as it was already evident that artificial insemination was going to be of very much greater use for dairy herds than for beef herds. For the purpose of determining whether a grant would be payable to the Board the profits or losses on all the Board's centres, dispersed over the country, would be added together and only the net loss would be met by an Exchequer grant. The same principle was to be applied in the case of other organisations operating two or more centres.

By Clause 5 the Milk Marketing Board would be able to serve all breeders of cattle within the area of operation of any of its centres, irrespective of whether or not they were registered producers of milk. This was apparently a small Measure, but he commended it to the House as one that he thought would be a useful one designed to help them in their livestock improvement campaign.

Mr. Wootton-Davies: Did the right hon. Gentleman want this money to enquire into the process of artificial insemination, or to carry on a practice which they all knew was going on in this country to-day? The Chancellor of the Exchequer the other day, in describing research, said that it was an enquiry into something new. This practice had been going on in other countries for a number of years, but those countries had been trying other practices, and in these last 20 years had altered their opinions very much.

In this matter his own experience had not been too happy. The right hon. Gentleman said that this was a good thing for cattle. He thought that people who kept cattle, horses, sheep and pigs would tell him that if it had been of any use in any direction, it had been in the case of the horse—horses more than cattle. One of his own constituents, who when he first came to that House, said that he ought to make himself a nuisance and persuade the Government to do away with all except a few bulls and to adopt artificial insemination entirely, had now completely altered his ideas. He (the speaker) suggested that in this process we were not trying, as science had so often done, to explain natural processes, we were doing something more. Nature had never been beaten. Nature could not be deceived. The right hon. Gentleman was suggesting an enquiry into a phase of the secret of life which science was trying to unravel, and it would be much better if he came to the House and said, "I want money to enquire into this thing."

The mating of animals was not just like mixing an acid with an alkali. It was something more. The House ought not to approve this method without due consideration. We must hesitate about a matter of this magnitude; we must "stop, look and listen." We must say to the Minister of Agriculture: "In this matter you must have the greatest biologist and the greatest scientist; and, above all, you want a philosopher." There was more in this than mere biology. Had we got the people capable of deciding a thing like this? After it started it went a great deal farther. He was told that two children had been produced in England by this method. A stone started an avalanche. If we interfered with the maternal instinct, might we not interfere with the future production of the species?

Mr. Price congratulated the Government on bringing in a Bill of that kind. Although it was going to expend about £250,000, he thought on the whole it would be money well spent. He had seen one of the artificial insemination centres at Cambridge and the work of Dr. Hammond, and he was satisfied from what he could see that very important work had been done there. It was surely clear that this country was in a pioneering stage. The Russians had done tremendous work on this for years, and it was of very considerable practical application there, but we must not argue that for that reason we could apply it indiscriminately here.

In this country we had a right to regard our livestock as being of a very high standard or, at least, to be accurate, he should say we produced the finest livestock in the world, but our average standard was not as high as it should or could be. This, he thought, was possibly one way in which we could more rapidly improve it. The problem of rapid increase was going to be very important. The Continent of Europe was now terribly short of livestock, and a rapid rate of increase would be secured by eliminating the longer natural process. But we had to be very careful in this country, because our main problem was not so much a rapid increase as a rise in the quality of our livestock, particularly dairy livestock. He did not think much could be said with regard to beef cattle. We had some very fine strains of herds and our breed societies had kept them up to a pretty good level. Much of our show points, and the competitions at shows, had been concerned with the physical characteristics of cattle for beef, but, unfortunately, there had been nothing like that amount of work done in regard to competitions with a view to increasing the milking qualities of our livestock. This is where he felt there was a certain need.

His right hon. Friend had just said that there was not only a prospect of rapid improvement if this matter were well done, but there was a danger of a rapid deterioration if we did not get the right stock. It all depended on what kind of bulls we were going to use in these insemination centres, and it was extremely difficult to be sure, in regard to dairy stock, that we had the right types, because you could not judge so much from show points. You had to look at records, and go back and look at the ancestry of the animal, and see what its performance had been. Unfortunately, in many of our herds we had not the data to go on. Take the Shorthorn breed as an example. It was very difficult to pick out a dairy shorthorn bull which had a really good dairy record behind it. There was nearly always some fault in the dairy records. There were certain breeds like the Ayrshires and Friesians where we could be on surer ground.

He was not at all sure whether we had got, in regard to artificial insemination centres, the stock we could quite certainly use for improving the quality of our dairy cattle. He should like to know from his right hon. Friend the Parliamentary Secretary what steps were being taken to see what class of bulls, particularly of the dairy kind, were being used and whether the Ministry were satisfied they had good records. He knew that the Ministry was now taking steps with regard to licensing bulls, with a view to permitting the licensing of bulls to be connected with dairy records, the ancestry of the bull. Up to now this had not been so much the case. They had judged them, and given licences to bulls, on physical points, on conformation. In view of the new regulations, which he understood the Ministry had issued, instructing livestock officers to give licences for bulls on a new basis*, he hoped the Ministry had been extremely careful as to the type of dairy bulls being used in these artificial insemination centres. While uttering this note of warning and calling attention to the fact that it was the standard of dairy stock that we mainly needed to raise, in general he gave support to this Bill.

Wing-Commander James welcomed this small Bill and hoped it would secure further research into this process, which was potentially useful but possibly dangerous, if not properly controlled. Would the Minister dispel a certain fear that had been aroused that there might be discrimination against the less popular breeds?

The Joint Parliamentary Under-Secretary of State for Scotland (Mr. Chapman): Mr. Wootton-Davies made a scientific approach to this matter and spoke with some considerable knowledge of it. He would not expect him at that late hour to go into the pros and cons of artificial insemination, because that House approved the principle of research into artificial insemination in the Agriculture (Miscellaneous Provisions) Act, 1943, and in the course of the Debate on that Act his right hon. Friend the Minister of Agriculture made it very clear that this was confined to research, and practice related to that research, into artificial insemination connected with animals alone. In the preamble and short title of the present Bill that was further reinforced. He thought, too, his honest scientific fears could be set at rest, as the two agricultural Ministers had arranged in the printed regulations to control this practice from all angles.

He trusted that his hon. Friend would agree that they were taking every possible precaution to see that this matter was kept under proper control, and that it progressed in an orderly manner.

There could not be the application of methods in this country on the scale there was in Russia. That was why they desired to learn more about the practice of artificial insemination here. Mr. Price also raised the question in relation to milk production. There had been a vast increase in the consumption of milk, and it was necessary that it should go on increasing, but only milk of the best quality. The Milk Marketing Board was the biggest organisation handling milk. He would also suggest to the House that one of the ways of increasing the milk production might be by use of artificial insemination in small herds. Very often the owner of a small herd was unable to buy a good bull, particularly in the more remote rural areas, with the cost of transport. We wanted to get rid of the scrub bull. He could also assure the House that they were giving the closest attention to the selection of the bulls that were to be used for the purpose of artificial insemination. It was obviously the foundation of the whole future of the scheme, and there would be thorough control.

Some apprehension had been expressed about the possibility of discrimination between breeds, but he could say at once that there was to be no discrimination. Every cattle breed society could set up an approved centre. The point had also been raised about the Milk Marketing Board and its inclusion in the Bill. This was the biggest producer-controlled organisation and for that reason it was the obvious channel for carrying out the suggested scheme.

Questions

Dog Owners (Fines)

Sir J. Lucas asked the Minister of Agriculture if his consultations with regard to dog owners who paid £1 a day fines to keep their dogs alive had now reached any conclusion.

Mr. Hudson: Yes, Sir. My information is that the number of cases in which dog owners are prepared to incur the penalty of £1 per day rather than obey a court order for the destruction of a dangerous dog is few. In any event, legislation would be necessary to provide for an alternative penalty, and I understand that it is not possible to hold out any hope of legislation on this subject.

Sir J. Lucas: Will not my right hon. Friend suggest that magistrates might remit the fines if the dogs were sent to a quarantine

* See "Notes and News."—*Editor.*

station, where they could not do any harm, and so prevent the law being brought into contempt by the imposition of such fines?

Mr. Hudson: That Question should be addressed to the Home Secretary.

* * * * *

Agriculture: Long-term Policy

Mr. Driberg asked the Minister of Agriculture on what date his Department's discussions with the National Farmers' Union and other interests on long-term agricultural policy began; how many meetings have been held and how frequently they are being held at present; and when it is expected that the discussions will have been completed.

The Minister of Agriculture (Mr. R. S. Hudson): Discussions of an exploratory character on various aspects of agricultural policy both in the transitional period and thereafter have taken place during the past 18 months. An important feature of the discussions was the procedure for fixing agricultural prices during the next few years, the first results of which were announced on March 7th last. Discussions will be continued on other aspects.

Mr. Driberg: Can the right hon. Gentleman say how long they are likely to go on and when he will be able to make the long-awaited statement of policy?

Mr. Hudson: No, Sir, I am afraid I should have to have the gift of prophecy before I could do that.

Mr. De la Bere: Can we know whether the result will be beneficial to the farmers, because that is the only thing that matters?

NOTES AND NEWS

The Editor will be glad to receive items of professional interest for inclusion in these columns.

Diary of Events

June 5th.—Meeting of the V.V.B.F. Ladies' Guild, at 10, Red Lion Square, W.C.1, 2.30 p.m.
June 5th.—R.C.V.S. Council and Committee Meetings.
June 5th.—R.C.V.S. Annual General Meeting, 10, Red Lion Square, W.C.1, 12 noon.
June 5th.—V.V.B.F. Annual General Meeting, 10, Red Lion Square, W.C.1 (following above).
June 6th.—R.C.V.S. Committee Meetings.
June 7th.—R.C.V.S. Council and Committee Meetings.
June 8th.—Meeting of the South Wales Division, N.V.M.A., at Langland Bay Hotel, Mumbles, Nr. Swansea, 2.15 p.m.
June 13th.—Meeting of the Editorial Committee, N.V.M.A., 36, Gordon Square, W.C.1, 2.30 p.m.
June 15th.—Meeting of the Welsh Branch, N.V.M.A., at Shrewsbury (Council Chamber, The Castle), 2.30 p.m.
June 15th.—Meeting of the Society of Women Veterinary Surgeons at Wilmslow, Cheshire.
June 18th.—Meeting of the Overseas Committee, N.V.M.A., at 36, Gordon Square, W.C.1, 2.30 p.m.
June 21st.—Summer Meeting of the Central Veterinary Society (*change of date from June 7th*) at the Ministry's Veterinary Laboratory, New Haw, Weybridge, 2.15 p.m.
June 27th.—N.V.M.A. Committee Meetings in Edinburgh:, Sub-committee on First Aid Handbook, 10.30 a.m.; Organising, 12 noon; Appointments, 2 p.m.; Finance and General Purposes, 3 p.m.
June 28th.—N.V.M.A. Meetings in Edinburgh: Joint Parliamentary and Veterinary Officers and Public Health Committee, 10.30 a.m.; **Council Meeting**, 11.30 a.m.

* * * * *

N.V.M.A. Meetings in Edinburgh

As announced above, meetings of the N.V.M.A. will be held in Edinburgh on June 27th and 28th, 1945. Members are urged to reserve rooms without delay as hotel accommodation is likely to be limited. Those who have difficulty and who would be willing to share a room should notify the General Secretary as soon as possible stating the dates on which they require accommodation.

The Principal of the Royal (Dick) Veterinary College has kindly given permission for members attending the meeting to use the College refectory for lunch on both days subject to advance arrangements being made. Will members who wish to take advantage of this please notify the General Secretary on or before June 15th

Refresher Tuition on Return from the Forces

The N.V.M.A. is anxious to do everything within its power to meet the demand for refresher tuition which is being made by veterinarians returning from the Forces. To this end it is proposed to compile a list of practitioners willing to give such tuition and to whom applicants who wish to receive such instruction—for example, in infertility problems—can be referred. Members who are prepared to assist in this matter are requested to send in their names to the General Secretary, N.V.M.A., 36, Gordon Square, London, W.C.1.

* * * * *

"N.V.M.A." MOTOR INSURANCE SCHEME

In view of the revival of the basic petrol ration, members may like to know that the above-mentioned special scheme of motor insurance (exclusive to members of the N.V.M.A.) is still fully operative and that cover can be issued or reinstated immediately upon application to the Managers (appointed by the N.V.M.A.), whose new address should be carefully noted as follows: S. H. Cannon & Co., Ltd., Incorporated Insurance Brokers, 112/114, Fenchurch Street, London, E.C.3. Telephone: ROYal 7687/8/9.

The Personal Accident and Sickness Insurance Scheme also continues to be fully operative on the special terms exclusive to members of the N.V.M.A. The many advantages of these policies, especially drafted and designed to cover all features peculiar to the veterinary profession, are widely appreciated and continue to receive increasing support. Full details may be obtained, on request, from the Managers, S. H. Cannon & Co., Ltd., as above.

* * * * *

NATIONAL AIR-RAID PRECAUTIONS FOR ANIMALS COMMITTEE

With the end of hostilities in Europe and the closing down of A.R.P. and Civil Defence Services, all A.R.P. equipment supplied by N.A.R.P.A.C. is being recalled.

Members of the profession who have assisted N.A.R.P.A.C. are therefore requested to return all equipment, veterinary or otherwise, supplied by N.A.R.P.A.C., such as first-aid boxes, decontamination outfits, instruments, respirators, steel helmets, and other issues, addressed to the Secretary, N.A.R.P.A.C., Byfeld Hall, Byfeld Gardens, Barnes, London, S.W.13. All equipment should be sent carriage forward.

* * * * *

PERSONAL

Veterinarian Election Candidate's Five Years as Mayor

Mr. Aubrey E. Ward, M.R.C.V.S., who has been adopted as the Liberal candidate for the Eton and Slough Division at the forthcoming General Election, has had a distinguished municipal career in a borough the population of which has now reached 75,000. This commenced in 1935, when Mr. Ward was elected to the Slough U.D.C. Slough was created a borough in 1938 and he was elected the second Mayor in 1940 and has been re-elected each year since—that is, five years as Mayor. He is a member of the Bucks County Council, and during the last four years has been Chairman of the South Bucks A.R.P. Emergency Committee. Mr. Ward has been in general practice in Slough since, in 1924, he was with the Ministry of Agriculture and Fisheries as a temporary veterinary inspector.

* * * * *

Birth.—Ottaway.—On May 24th, 1945, to Grace, wife of C. W. Ottaway, F.R.C.V.S., a brother for Mark.

* * * * *

Retirement Tributes.—At a recent meeting of the Bucks County Council it was reported that the Milk and Dairies Committee had learned with regret of the impending retirement of Mr. H. B. Collet, the Divisional Veterinary Inspector of the Ministry of Agriculture and Fisheries. They had expressed to him their appreciation of the excellent services which he had always rendered, and their best wishes for his future happiness and prosperity. In submitting the report to the Council, Councillor F. M. Kimber added, "I think, on behalf of the farming fraternity, I must express the regret of us all at Mr. Collet's retirement. We have always been dealt fairly with by Mr. Collet and I personally regret very much that he is going."

Farmers of North Hertfordshire and many from the neighbouring county of Bedfordshire did honour to Mr. W. W. Goldsmith, M.R.C.V.S., of Hitchin, at Hitchin Corn Exchange recently, to mark his retirement. The expression of the farmers' appreciation of his

services to them was conveyed through the medium of a substantial cheque, which Colonel J. F. Harrison, of King's Walden Bury, presented on their behalf.

Mr. Goldsmith acknowledged the many compliments paid to him, and (says the *Herts. Express*) the ceremony ended with musical honours "for one who had always been a friend of the farmers in North Hertfordshire."

* * * * *

R.C.V.S. OBITUARY

Arkcoll, George Spencer, Capt. late A.V.C., Russell Street, Leek, Staffs. Graduated London, March 23rd, 1886. Died 1943. (Notification just received.)

Carless, Francis John, J.P., "Ingestre," Mooi River, Natal, S. Africa. Graduated London May 16th, 1890. Died April, 1945.

Gordon, George, Capt. late R.A.V.C., Salisbury, S. Rhodesia. Graduated Edinburgh, December 17th, 1906. Date of death unknown.

Penhale, Richard E. L., J.P., Torrington, N. Devon. Graduated London April 1st, 1881. Died May, 1945; aged 86 years.

Sewell, Edward James Hernon, Sandbrook Cottage, Orrell, Nr. Wigan, Lancs. Graduated Edinburgh, December 18th, 1919. Died November 7th, 1944. (Notification just received.)

* * * * *

R.C.V.S. ANIMAL MANAGEMENT EXAMINATION

List of Successful Candidates

Glasgow:

Aharoni, Chanan (Credit)	Hamilton, D. F.
Anderson, R. Y. (Credit)	Harris, G. D.
Bain, Miss M. L.	Harrison, N. J.
Campbell, Miss D. J. (Credit)	Lawson, John
Douglas, T. A.	Lustig, Martin (Credit)
Dunlop, J. C. M.	Mair, C. P.
Ferguson, Wm.	O'Hagan, Charles
Glenroy, J. McL.	Williams, Miss L.
Goodwin, Robt.	Warnock, Hugh
Grindlay, Maurice	Wright, Miss C. M. F. (Credit)
Grisedale, J. A.	

Dublin:

Buckley, Thos.	Murphy, J. McD.
Burke, J. T.	Murphy, Michael
Fennelly, P. W. (Credit)	O'Byrne, Eoin
Galvin, T. A.	O'Connell, T. J.
Keenan, N. T. (Credit)	O'Connor, Daniel
Knightly, Michael (Credit)	Reihill, J. P.
Loughran, P. K.	Stewart, Paul
McCauley, P. J.	Sweeney, E. J.
MacClancy, B. N.	Walsh, J. T.
McIvor, J. G.	Woods, R. H.
Mundy, W. A.	Woulfe, M. R.

(*Concluded*)

* * * * *

GOVERNMENT AND ANIMAL DISEASES

"Lord Listowel's recent statement in Parliament on the subject of animal diseases has caused feelings of amazement and resentment among farmers—feelings that have by no means abated as a result of his partial retraction," states the *N.F.U. Record* (the official journal of the National Farmers' Union) in its May issue, and continues: "For a Government spokesman to use such extravagant language in criticism of a matter in which the Government itself must accept considerable responsibility is something of an embarrassment to those who have been grappling with the problem of cattle diseases. When the noble Lord expresses surprise that the Press should have committed to print his official words, he is merely adding to the perplexity now felt in agricultural circles.

"Farmers had hoped that the Ministries of Health and Agriculture had resolved their differences over objective planning, but Lord Listowel's attitude does not help to solve the difficulties of marrying practical steps to desirable achievement.

"Agriculture does not merely recognise the existence of cattle diseases; it is fully aware of the losses they entail, and for years has been pressing for means to their elimination. The record of Governments in this respect is not a happy one. In the first place, agriculture after the last war was discarded as an industry of social and economic consequence, and its subsequent condition was reflected vividly in the small scale planning for better herds. To make matters worse, the Government, as a war-time measure, refused any new entrants to the Attested Herds Scheme, although this ideal target for milk producers was subsequently reintroduced on the industry's representations.

"The industry's next step was to press for a 'Panel Scheme,' and the Ministry of Agriculture helped to sponsor it. With the National Farmers' Union and the Milk Marketing Board they entered into negotiations with the veterinary profession for a scale of charges that would enable whole herds to be visited regularly by veterinary surgeons. This scheme, after a promising start, had to be soft-pedalled because of a shortage of 'vets.' and vaccines, and to meet this position the industry itself helped to launch a fund that would provide facilities for the professional training of a bigger veterinary corps.

"Agricultural depression and shortsighted Government policy have prevented adequate development of research work and have restricted plans that the Ministry of Agriculture might have developed in other circumstances.

"One of the most serious incidents of the early war period was the withdrawal of assistance by the Government to the Milk Recording Societies. Recently, of course, the harmful effect of this move was officially recognised, and the Government are now collaborating with the industry in building up a strong milk recording movement, administered by the Milk Marketing Board.

"Most of the Government's sins of omission and commission were acknowledged in the recent Parliamentary debate by the Duke of Norfolk and other speakers, and the indications now given of a positive effort to raise the standard of animal health are welcomed by farmers everywhere. The ill-considered statements of Lord Listowel constitute an unwarranted departure from an otherwise factual and objective debate."

* * * * *

ADDRESSES OF DISEASE-INFECTED PREMISES

Swine Fever:

Berks.—Riches Sidings, Didcot (May 23rd).

Berwickshire.—No. 1 Courting, Woodheads Farm, Lauder (May 25th).

Derbyshire.—Alma Street, Alfreton (May 22nd).

Glos.—Horcott Cottages, Horcott, Kempsford, Fairford (May 21st); The Allotments, Down Ampney, Cirencester; The Paddocks, Down Ampney, Cirencester (May 22nd); Sties and Orchard, 2nd County Mental Hospital, Coney Hill, Gloucester (May 25th).

Northants.—Berrywood Mental Hospital Farm, Upton (May 26th).

Roxburghshire.—Mossburnford Farm, Jedburgh (May 22nd).

Wigtownshire.—Portslogan Farm, Leswalt, Stranraer; Airy Lemming Farm, Glenluce, Newton Stewart; Mote Hill Croft, Glenluce, Newton Stewart (May 23rd).

Yorks.—Valley Farm, Hutton Bonville, Northallerton (May 26th).

. . . . .

In view of the continued high incidence of foot-and-mouth disease, it is of the utmost importance that all should exercise the greatest care in personal disinfection when visiting farm livestock for any purpose, and report immediately the slightest suspicion of the existence of any illness having the remotest resemblance to foot-and-mouth disease.

* * * * *

HILL SHEEP ADVISORY COMMITTEE

Acting on a recommendation of the Agricultural Improvement Council, the Minister of Agriculture and Fisheries has appointed a Hill Sheep Advisory Committee to advise him upon the various problems confronting the hill sheep-industry in so far as such problems have not already been dealt with by the Committee on Hill Sheep Farming in England and Wales which reported early in 1944. In particular the Advisory Committee will be consulted in regard to any legislation to give effect to the recommendations of that Committee and of the corresponding Committee for Scotland.

The members appointed to the Advisory Committee are: Mr. R. Donald Scott, M.P. (Chairman), The Duke of Northumberland, Mr. J. V. Allen, Mr. S. J. P. Andrew, Mr. D. G. Brown, J.P., C.C., Captain R. H. Hall, Mr. J. Morgan Jones, Mr. Harry Lewis, Mr. R. P. Roberts, J.P., Professor R. G. White, M.Sc., and Mr. W. Wilson.

Mr. H. E. Bannister has been appointed to act as Secretary and all communications should be addressed to him at the Ministry of Agriculture and Fisheries, 55, Whitehall, London, S.W.1.

* * * * *

ARTIFICIAL INSEMINATION ON CO-OPERATIVE LINES

Ministry's Policy Exemplified in Hampshire

An event of some significance in the history of cattle breeding in this country took place at Lyndhurst, Hampshire, on Saturday, May 19th, in the official opening by the Duke of Norfolk, in his capacity of Joint Parliamentary Secretary to the Ministry of Agriculture, of the Hampshire Cattle Breeders' Society's Artificial

Insemination Centre, inasmuch as this is the first in the country to be opened on co-operative lines, thus exemplifying the declared policy of the Ministry that artificial insemination of cattle should be developed as a national service, centres to be operated by properly controlled bodies.

The opening ceremony, over which the Earl of Selborne, Minister of Economic Welfare, who is President of the Committee of Management of the centre, presided, attracted a large attendance, including Lord Irwin, Mr. R. H. Franklin, Principal Assistant Secretary, Ministry of Agriculture; Professor T. Dalling, Principal of the Ministry's Veterinary Laboratory; Mr. H. Twinch, Chief Livestock Officer of the Ministry; and Sir Alfred Wood, member of the Central Advisory Committee on A.I.

Mr. J. Turner, President of the National Farmers' Union, was given a hearty welcome home after his world tour, and declared (says the *Southern Daily Echo* in its report of the proceedings): "I found that Britain is still the best farmed country in the world."

Presiding over a luncheon held at the Crown Hotel before the opening, Lord Selborne said, amid laughter and applause, that the feelings of the agricultural industry towards the Ministry of Agriculture had undergone a significant change for the better during the past few years. Farmers had cause to be thankful for the splendid work the Ministry had done. "If they can't get us the right price for our produce it is certainly not the fault of the Minister or the Parliamentary Secretaries. They certainly try to do their best in our interests."

The Duke of Norfolk paid tribute to the farmers for all that they had done to safeguard Britain's food supplies, and declared that the Ministry of Agriculture had become a happy family.

Mr. G. N. Gould, Chairman of the Management Committee of the Centre, proposed the health of the guests, and stressed how much was owed to Mr. A. E. N. Ashford, the Hon. Secretary. It was largely through his efforts that the centre had been established. The Committee had worked hard and deserved the success they believed they would achieve.

Guests welcomed, in addition to those mentioned above, included the Mayor of Southampton (Councillor J. C. Dyas), the Deputy Mayor (Councillor R. J. Stranger, M.C.) and the President of Southampton Chamber of Commerce (Mr. F. R. Alderwick).

Mr. Franklin, replying, congratulated Hampshire on having the first centre organised on a purely co-operative basis, and Mr. Turner said that through such enterprises as the centre the agricultural industry was demonstrating that it no longer believed in sitting back and waiting for things to happen. It was out to get things done.

"Farmers' Happy Relations with the N.V.M.A."

Mr. Turner congratulated Mr. Gould on his initiative in the matter and spoke of the farmers' increasingly happy relations with the National Veterinary Medical Association.

Dr. W. R. Wooldridge, Chairman of the Council of the Veterinary Educational Trust, said that the centre was a clear indication of how efficiency could be secured by co-operation.

In inviting the Duke of Norfolk to open the centre, which has been established at the Grand Hunting Stables, Lord Selborne said that the Hampshire Cattle Breeders' Society was doing pioneer work. "We believe that if British farming is to survive in the New World it has got to be efficient and up to date in everything," he added. The industry had to go forward hand-in-hand with science.

The Duke of Norfolk, who is Chairman of the Central Advisory Committee of A.I., said the improvement of livestock had assumed an important place in agricultural policy and the need for improvement had become increasingly urgent because of the difficult position which would have to be faced in the next few years in the provision of meat and milk. Increases in the supply of milk would have to be obtained through higher yields rather than by an expansion of the dairy cow population.

The new system of breeding was of especial help to the man with a small herd. Many herds were too small to justify the purchase and upkeep of high quality sires, while, in some parts of the country, risks of disease operated against the use of a good communal bull.

The Minister of Agriculture had decided that artificial insemination of cattle should be developed as a national service and it was his intention, in general, that A.I. centres should be operated by properly controlled bodies, such as farmers' co-operative societies.

Development in Hampshire had been along the lines the Minister wished, and the county's first centre had been soundly based upon foundations laid by Mr. Gould, who had had much experience of the practice of artificial insemination before the establishment of a centre became possible.

The Duke congratulated everyone connected with the starting of the centre and voiced appreciation of the helpful spirit which had existed throughout the setting-up of the centre between the society and the Hampshire War Agricultural Executive Committee.

Handled properly, artificial insemination had a great future. It would go a long way to help in eliminating disease in British livestock.

The opening was followed by a parade of bulls, during which Mr. R. H. Smith, Technical Officer, Hampshire W.A.E.C., gave a commentary.

Mr. Gould announced that by the end of August it was hoped to have eight bulls at the centre. He thanked Mr. E. Conn, Chief Veterinary Officer of the centre, Mr. S. Williams, Business Manager, and Mr. P. Hiscox, Stockman, for all the hard work they had put in. The Andover sub-centre would be opened on September 1st.

Professor Dalling said that certain diseases could be controlled by artificial insemination, but not all diseases. It was necessary to go slowly and carefully with the practice.

It may be added that Hampshire Cattle Breeders' Society is a non-profit-making organisation. It is managed by farmers, financed by them and is not subsidised in any way. Its aims are to improve the type, quality and productivity of the cattle bred in Hampshire, and to provide facilities for artificial insemination for members' cattle.

Shorthorn and Guernsey bulls were purchased after most careful selection, special attention having been paid to milk and butterfat records of their ancestors and of their progeny.

The bulls have been approved by the Ministry of Agriculture and have passed stringent veterinary tests for freedom from tuberculosis, contagious abortion and other diseases, and have been approved for their high fertility rate.

Chief Veterinary Officer at the centre is Mr. E. Conn, M.R.C.V.S., who has specialised in artificial insemination and the breeding diseases of dairy cattle.

[As recorded in our Parliamentary Columns this week, the Agriculture (Artificial Insemination) Bill received its Second Reading in the Commons prior to the Whitsuntide Recess. We give an extended report of the brief, but interesting, proceedings.]

* * * * *

NEW BULL LICENSING REGULATIONS

Announcing the above, the Ministry of Agriculture states: A great step forward in the improvement of British livestock was taken in 1934, when by Regulations made under the Improvement of Livestock (Licensing of Bulls) Act, 1931, it became compulsory for all bulls in England and Wales over the age of ten months to be licensed by the Ministry of Agriculture. Licences were only granted where the Ministry was satisfied as to the bull's health, conformation, and power to beget satisfactory stock. The standards for bull licensing have been progressively raised during the past eleven years and many inferior sires have been eliminated to the general advantage of our herds.

Now that livestock improvement is of even greater importance the Minister of Agriculture has taken further action to raise the standard of bulls in use, and to identify more easily those that are suitable for milk and beef production respectively. Using the powers especially granted to him for this purpose by Section 6 of the Agriculture (Miscellaneous Provisions) Act, 1944, the Minister has made new Bull Licensing Regulations which include several novel features.

The new Regulations will come into force on June 24th and after that date there will be three types of licence for bulls in England and Wales. Beef Bull Licences will be granted in respect of bulls entered in the Pedigree Register of approved beef Breed Societies or bred of parents in the Pedigree Register or Grading-up Register of such societies.

Dairy (Official Milk Record) Licences will be issued in respect of bulls whose dams and sires' dams have attained officially recorded milk yields of at least 600 gallons with the first calf or 700 gallons with the second calf or 800 gallons with a subsequent calf in a lactation period of not more than 365 consecutive days.

Where a bull is satisfactory as to conformation, freedom from diseases, and power to beget satisfactory progeny, but is nevertheless unable to fulfil the special additional requirements for a beef or dairy licence, a third type of licence, to be known as a General Class Licence, will be issued.

Discriminating farmers will select their bulls with the aid of the information given by the type of licence. It will, in future, be much easier for a dairy farmer or a beef producer to make sure that the bull he buys is of a type suitable to his herd and to his farming system.

No further licences will be granted in respect of cross-bred bulls, *i.e.*, which are neither registered nor eligible for registration as pedigree bulls nor which fail to conform to the standard of type laid down by the appropriate Breed Society. This does not mean, however, that non-pedigree pure bred bulls or bulls whose ancestry is not entirely confined to one breed will necessarily be refused a licence provided that they conform to the standard of type of a recognised breed.

IMPROVING CYPRUS POULTRY

"A considerable improvement in the quality of local poultry has been achieved through the activities of the Poultry Section of the Department of Agriculture of Cyprus," states the *Colonial Office News Service*, and continues: "As the result of the sale of hatching eggs over a number of years, Rhode Island Red blood is now widely distributed throughout the island. Rhode Island Reds have proved the most satisfactory of all imported breeds. However, like most breeds not indigenous to a country, they fail to equal local mongrels in general hardiness, including ease of rearing. The Department of Agriculture at its stock farm at Athalassa is endeavouring to develop a uniform breed from selections of local black hens which possess most of the merits of imported utility breeds combined with native hardiness."

* * * * *

The Service departments, in consultation with the Ministry of Agriculture, are considering a scheme to enable members of the Services to bring home dogs which they have acquired abroad.

* * * * *

"*Toxicity Trials with the Insecticide '666' on Rabbits, Sheep and a Bovine.*"—In connection with the article by Mr. H. S. Purchase published in our issue of May 5th (*Vet. Rec.* **57**. 211), we are asked to state that information has now been received that the material supplied to Dr. Purchase for these tests was not the pure chemical but a 10 per cent. concentration.

CORRESPONDENCE

The views expressed in letters addressed to the Editor represent the personal views of the writer only and must not be taken as expressing the opinion or having received the approval of the N.V.M.A.

Letters to the Editor should reach the Office not later than by the first post on Monday morning for insertion in following Saturday's issue.

* * * * *

CLINICAL PATHOLOGY

Sir,—Although opinion within the profession is divided as to how and where veterinary education should be conducted, we are all agreed that considerable improvement in the facilities and expansion of staff for both education and research are necessary. To effect this requires, firstly, a considerable increase in financial support and, secondly, a sufficient number of men and women trained in the various special aspects of veterinary science under people well qualified by knowledge and experience to instruct and encourage them. The need for improvement is particularly great in the field of clinical pathology. It is not sufficient to enumerate symptoms of disease, such as dyspnoea, emaciation, diarrhoea, ascites, etc.: every effort must be made, using all the resources of science, to find the cause of these symptoms and so learn something of the disease processes concerned in producing them. The varied and intricate procedures regularly adopted in hospitals today require laboratory facilities and staff which only a large college or institute can supply. It must be our aim to see that not only are such facilities made available for research and teaching purposes, but that any methods which eventually prove useful in clinical diagnosis are made available to the practitioner by providing hospital accommodation and services for his patients when the methods to be used are beyond what he can accomplish unaided.

To illustrate the variety and complexity of modern methods a summary of the procedures employed in investigating a case of asthma in a dog, as reported in a medical journal (*American Journal of Clinical Pathology*, July, 1944, page 413), may be of interest. An electrocardiogram and fluoroscopic examination showed right heart enlargement and preponderance, and auricular fibrillation. Blood pressure was 150/180. Blood cultures were negative. Estimations of haemoglobin, cell counts and differential leucocyte count showed anaemia and indicated a probable low grade infection. Analysis of blood and ascitic fluid showed low plasma proteins, reversed albumin/globulin ratio and high content of albumin in the ascitic fluid, and indicated liver damage and hypoproteinaemia. The circulation time was twice the normal value. Clinical diagnosis from these studies was: enlargement of the right ventricle, heart failure, hepatic cirrhosis and ascites. These conclusions were confirmed at subsequent autopsy, except that the liver showed damage due to passive hyperaemia, but there was no cirrhosis. The asthma, ascites, oedema and cardiac enlargement were due to right heart failure, caused by pulmonary fibrosis and emphysema with associated arteriosclerosis. The lung changes were probably due to an unresolved broncho-pneumonia.

It is not suggested that such a detailed investigation could ever become a routine, but it is maintained that facilities for such work are needed for the prosecution of research into disease problems. For this work a team of specialists is needed—physiologist, biochemist, haematologist, bacteriologist and others. It is essential that young men and women should be encouraged by grants and scholarships to become trained in these subjects so that they may undertake research problems and also, as teams working in colleges and institutes, assist practitioners by making available to them the methods of diagnosis which are continually being devised. If such men and women are to be attracted to these careers they must be provided with a salary sufficient for maintenance during their period of study and must be assured of a demand for their services when their preliminary training is completed. The Studentships for Research in Animal Health provide facilities for such training and the Veterinary Educational Trust is an additional source. The need of the future is for sufficient financial assistance for colleges and research institutes to enable them to employ these trained personnel in the fields in which they are most needed. Physiology and morbid anatomy have attracted few veterinarians, pharmacology and haematology hardly any. Bacteriology has been the favourite field, but in this field as in so many others the services of the chemist have become indispensable.

There is one further point of some importance. Clinical pathology includes certain simple procedures, mainly qualitative, which are readily carried out by the practitioner, and other more complicated techniques requiring expensive apparatus and special skill. The latter can be carried out only by workers specially trained in scientific methods and with adequate laboratory facilities at their disposal.

Bacteriologists have made valuable contributions to clinical pathology, but they would readily admit that knowledge of the organisms isolated from diseased animals does not necessarily explain all the features of a disease. Let us hope that physiology, pharmacology, haematology, toxicology and other neglected aspects of veterinary science will soon come into their own in this country.

Yours faithfully,

"Pendals," Hampstead Norris, Newbury, Berks. E. G. White.

May 19th, 1945.

* * * * *

"WARE WIRE"

Sir,—The interesting article by Mr. Rorrison on traumatic peritonitis in your issue of May 5th, prompts me to call attention to the possibility of an increased incidence of these cases in certain districts following upon the war. In colliery districts they are very common owing to the use of old pit-winding rope to form fences or reinforce the hedgerows. I met with an average of 20 to 30 cases of traumatic pericarditis over a number of years, before the danger of this "economy" was pointed out, and the great majority were due to pieces of this wire rusted off on to pastures. The new danger which I suggest refers to the many areas in the country in which the Royal Corps of Signals received and are receiving their training. In one such camp known to me many thousands were trained over several years, and part of the course involved the wiring of telephone and telegraph poles. In doing this work and making connections, numerous pieces of the copper wire used are necessarily snipped off. The camp I refer to was situated upon grazing land which probably will revert to the same purpose. About a year ago I walked over this land and had no difficulty in picking up scores of pieces of wire of various lengths. The danger of the careless discard of such wire has always been recognised by the G.P.O., with its many thousands of miles of wired poles on or adjoining agricultural land. Despite, however, the stringent regulations regarding the disposal of these snipped off pieces—valuable in themselves—they may be disregarded with fatal results. Many years ago I had three fatal cases on one premises due to this wire in a period of about 13 months. It must be mentioned that the wire used by the G.P.O. is of a special gauge, made for and restricted to its sole use, and can therefore be easily identified. In the cases just mentioned the identity and source of the fatal wires was established to the satisfaction of the postal authorities, and full compensation paid for the losses sustained. One more practical point. As copper wire becomes blackened after ingestion, it behoves the practitioner to examine with care all fatal wires found lest it be missed that they are of copper. Scraping settles that point, and if it fits the G.P.O. gauge its origin points to one direction only, so "Ware Copper Wire."

Yours faithfully,

Sandy Lane, Prestatyn, N. Wales. E. P. Edwards.

May 19th, 1945.

* * * * *

VETERINARY EDUCATION

Sir,—I was most interested and somewhat intrigued to learn from Mr. Lishman's letter of "facts" that I had "been compelled to abandon his (my) original claim that the recommendations of the Second Report of the Committee on Veterinary Education in Great Britain . . . did not in fact abolish the one-portal system of entry into the profession." Unfortunately Mr. Lishman does not quote me in support of this "factual" statement. On the contrary

I still hold the views expressed in the report referred to, and I aver, without fear of truthful contradiction, that so far as the teaching and examination of veterinary students are concerned the Council, R.C.V.S., will have greater powers if the above recommendations become law than those it possesses at present.

Under its existing constitution, despite Mr. Lishman's second "factual" statement, the R.C.V.S. has no control whatever over the teaching at the veterinary schools. I would ask Mr. Lishman to quote the clause from either the acts or the orders governing the present conduct of the R.C.V.S., which gives to the Council powers over the teaching at the affiliated schools. These schools are far more independent of the R.C.V.S. than would be the proposed university schools. Even the Council's control over the examinations is far less than is frequently stated, for the choice of examiners before the Council has for many years been very limited owing largely to the impossibility for the majority of practising veterinary surgeons to absent themselves upon our present prolonged examination tours.

The recommendations of the Committee, however, if they were implemented, would give to the Council a supervisory power over the teaching and the examinations at all universities, and entrance to the profession would still be only after passing examinations fully approved by the R.C.V.S. and the licence to practise would still remain membership of the R.C.V.S.

No, Mr. Lishman's letter in your issue of May 26th is about as factual as his electioneering letter circulated jointly with Dr. J. T. Edwards, with his glaring mis-statement "Vote for yourselves and *not* for others." However, this letter was certainly helpful to the profession as indicating (with what truth I do not know) that 14 of the candidates before us are rigidly opposed to progressive change. Frankly, knowing some of these gentlemen intimately, I do not believe the implications of the profession's self-styled "fact finders."

Yours faithfully,

Bentley Hyde, Priory Drive, Stanmore, Middlesex. W. R. Wooldridge.

May 27th, 1945.

* * * * *

Sir,—In *The Veterinary Record* of April 28th there is a letter signed "Graduate 1944," in which an anonymous contributor makes most serious allegations against the examiners of the Royal College of Veterinary Surgeons, alleging that the substantial majority of the students regard the examination system as most unsatisfactory, and that this view is shared by members of the teaching staffs who, in addition tell the students that "the examiners wade through 'writtens' in a conscientious hurry, each marking only a *portion* of each student's paper." What will be the reaction of the gentlemen concerned against such defamation of their character, it is not within my province to conjecture. At any rate, I think it is a matter that should be taken up at once by the Council of the Royal College. I would like to add that I hardly know any of the examiners, even by name.

Yours faithfully,

Clifford Manor, Stratford-on-Avon, Warwickshire. Graham Rees-Mogg.

May 22nd, 1945.

* * * * *

THE VETERINARY EDUCATIONAL TRUST

Sir,—Amidst the welter of correspondence on veterinary education and the future of the profession, it seems as well to draw the attention of members to the fact that research scholarships under the above Trust are being granted to non-veterinarians. While one cannot but appreciate the ideals of the sponsors of the scheme in launching this appeal to public charity to aid veterinary research (an appeal which should be wholly unnecessary in a State realising and implementing its duties to agriculture and *inter alia*, the veterinary profession) the granting of veterinary research scholarships to graduates other than veterinarians is a slight on the members of this profession and a reflection of the attitude of mind of some educationalists towards the quality of our graduates.

There are enough keen and intelligent younger members of the veterinary profession who would welcome the opportunity to undertake research and who are capable of specialising in any one branch, given the opportunity, to whom the veterinary research scholarships should be made available, without the management of the Trust going outside the profession and granting these scholarships to science graduates.

The present position is peculiarly analogous to that pertaining in the Colonial Veterinary Service before the war, under which science graduates were offered scholarships to the veterinary colleges. Such a policy was completely at variance with the true interests of animal health, for many of these graduates took the scholarships to veterinary colleges not for any love of veterinary work but as a welcome outlet on a glutted market. The obvious way to obtain specialists in a profession is from within the profession, *i.e.*, from people who are there because they want to be.

The argument may be advanced that as the majority of the younger generation of veterinarians are serving with the Armed Forces they are not at liberty to compete. The obvious answer is that in such case the granting of scholarships should be suspended until these men *are* in a position to compete. It would be grossly unfair if these scholarships were filled by non-veterinarians (presumably excused military duty) simply because the younger members of our profession, while serving their country, are unable to compete for them.

Yours faithfully,

Danebury, 31, Approach Road, Margate, Kent. H. Ivor Field.

May 16th, 1945.

. . . . .

Sir,—I thank you for giving me the opportunity of commenting upon the letter received from your correspondent, Mr. H. Ivor Field.

I need scarcely say to those of your readers who have followed, and in many instances assisted with, the development of the Veterinary Educational Trust, that the Council of the Trust is in full sympathy with the views at the root of Mr. Field's letter. This is evident from the fact that the main aim of the Trust is to assist with the furtherance of veterinary science and veterinary specialisation.

But whilst it is agreed that no person other than a veterinary surgeon should be encouraged to specialise in many branches of veterinary science, the Council of the Trust shares the views of others that there are some branches of our science wherein useful work may be done by scientists other than veterinarians. This, surely, is acknowledged by the profession in that such scientists are appointed to important posts at veterinary colleges, and by the warmth of the welcome we give to them when they join in our scientific discussions. On the other side of the picture we may recall that veterinarians have been elected to Beit Memorial Fellowships for Medical Research, Commonwealth Fund Fellowships, etc., etc.

Perhaps your readers would prefer to draw their conclusions upon the question of whether or not the Veterinary Educational Trust is assisting the advancement of veterinary science and practice from its record to date. Briefly, it is now assured of a capital sum of at least £200,000, yet despite the fact that all this is not yet to hand and that much more must be collected, the Trust has already made the following awards:—

12 undergraduate scholarships,
4 final year studentships, and
6 research fellowships.

In addition, two students of merit, who would otherwise have been unable to complete their courses through no fault of their own, are being actively assisted to qualify.

Furthermore, it is hoped shortly to elect one or more research fellows and make five further awards of final year studentships.

Of the six research fellows so far elected, only one is not a veterinary surgeon and he is a zoologist who has already carried out important work upon applied entomology connected with the sheep blowfly problem.

I trust this record will be considered one worthy of the profession and one meriting its support.

Yours faithfully,

W. R. Wooldridge,
(Chairman of Council,
The Veterinary Educational Trust).

40, Westminster Palace Gardens, Artillery Row, London, S.W.1.

May 23rd, 1945.

* * * * *

THE SLAVE MARKET

Sir,—I do not know who Mr. Malcolm Park is, but he appears to have little idea of present-day method and system. If he reads the Presidential Address on page 235 of your issue of May 19th he will perhaps understand why neither tradesmen nor professional men should be "slaves of the lamp." Most veterinary surgeons nowadays have fixed hours which are notified and which include early messages which are not usually given by what are known in Norfolk as "afternoon farmers." Work can be done if there is consideration by clients for veterinary surgeons as well as consideration by veterinary surgeons for farmers without work being carried out at any odd hour of the day and night. Present applications for assistants include hours of leisure and times for education and relaxation and there are no advertisements for men to keep their noses for ever at the grindstone.

Yours faithfully,

Bolton. G. Mayall.

May 21st, 1945.